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THE THIRD INGUINAL RING[1]

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FASCIÆ present problems of such profound interest that no excuse is necessary in submitting a thesis on so absorbing a subject. Bland Sutton (4) and others have shown that the higher the evolutionary plane of the animal, the more complex become the fibrous structures such as fascial planes and ligaments. Moreover, reptiles and amphibia show little in the way of fasciæ or intermuscular septa. In man these structures reach a high development and much has been learned from human morphology by their study. Elliot Smith, Zuckerkandl, Proust, Schwalbe, Denonvilliers, Kirmisson, and others have, by their investigations, solved many of the riddles presented by the pelvic fascial layers. It remains for others to elucidate with equal clearness, the fasciæ elsewhere. This work is an attempt to enable the superficial fasciæ of the lower abdomen and perineum to be better understood and to show that important surgical conditions such as ectopia testis may be explained on purely anatomical grounds.

The investigation embodied in this paper was instigated by a purely fortuitous circumstance. Reading one of the surgical periodicals, the writer met with an anatomical statement which seemed quite incorrect. On examining certain cadavers, he found that the remark in question was partially true. In pursuing the subject further he found it to be of such surpassing interest and practical importance that it was decided to make it the subject of a thesis.

The article referred to was written by Carl Goodwin Burdick, M.D., and Bradley L. Coley, M.D., of New York, and is entitled "Abnormal Descent of the Testicle." As their article will be quoted from extensively, the writer would like to pay tribute here to their careful anatomical observations and surgical deductions. Though disagreeing with many of their findings, they have yet pointed the way for these researches, and the writer is accordingly grateful to them.

Among other things they say: "To gain a clear understanding of maldescent of the testicle, it is essential to appreciate the anatomy of the superficial fascia of the lower abdomen and groin. This consists of two layers, the superficial stratum called Camper's fascia and the deeper, Scarpa's fascia. The former passes downward in front of the spermatic cord and becomes continuous with the dartos of the anterior part of the scrotum. The latter, Scarpa's fascia, descends internally over the pubis and fuses with Colles' fascia of the perineum, laterally it passes over Pouparts ligament and becomes continuous with the fascia lata of the thigh and is also attached along the rami of the ischium and pubis. . . . If one's fingers are passed between the two layers (Camper and Scarpa) they easily enter the scrotum; but, if inserted behind the posterior layer they enter a space of loose tissue which

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at first may give one the impression of being in the upper part of the scrotum, while actually the fingers are in the loose areolar tissue of the upper and inner thigh." It is this last sentence which was referred to as instigating this inquiry. It will be noticed that the writers consider that Scarpa's fascia passes behind the spermatic cord, or maldescent occurs.

It will also be seen that this description differs entirely from the usual account of the fasciæ as given in anatomy textbooks. So striking is the passage that the opinion of surgeons in this City was solicited about it. They agreed with the present author that Burdick and Coley were mistaken. The first specimen examined in the dissecting room showed a large fascial process *behind* the cord, which process was found to be a part of Scarpa's fascia.

The anatomy of the fascial planes of the scrotum and lower abdominal wall was therefore investigated. The writer has taught anatomy for 10 years, and must candidly state that the fasciæ in question have never been thoroughly understood by him. He has considered them as unpleasant to teach about and avoided the matter as much as possible. The impression he has received from other teachers leads him to conclude that they dislike the subject just as much. It would seem that these connective tissue sheets are ill understood generally, so much so that a congress of learned and famous anatomists, while relegating Morgagni, Schwalbe, Zuckerkandl, Wrisberg, and others to the realms of history, had sufficient respect for these fasciæ to leave them as they were, dignified by the names of Camper, Scarpa, and Colles. The subject of ectopia testis is obscure and not well understood, and is also of great surgical and economic importance. Anything which renders its etiology less obscure is necessarily important. It is hoped to show in the following pages that anatomical facts may go far to explain the situation if not the cause of the ectopic testicle.

Twenty cadavers have been examined. Fifteen were adult. These were all natives (Kaffirs). Five were newborn or fetuses of 5-months and over; these were European. Dissection and injections of red lead were the methods used. The work was confined to males. Entirely different factors obtain here to those in the female, in whom the fasciæ are of scant practical importance. It is hoped to pursue this aspect of the research at a later date.

The relations of 40 normal testes have therefore been examined, together with the fasciæ and perinea. Subjects of all ages were used, from young fetuses to old men of 80. Age in no way effects the findings which are common to all males. In fact, the fascial layers and pouches are better marked in newborn infants. It has been considered proper to deal seriatim with the various anatomical structures investigated. Subsequently the clinical and surgical bearings of the anatomical findings will be discussed.

ANATOMY

The scrotum is formed during the fourth month by the external genital folds which form the labia majora in the female (Keith).

About the end of the third week of development, when the limb buds have appeared, the mesoblastic cells of the limbs and body wall become grouped to form the bones (paraxial mesoblast), muscle plates, walls of vessels, and sheaths of nerves. The cells having become differentiated, numerous cells are left over which form the basis in which the specialized cells and groups of cells are packed and ensheathed. This undifferentiated mesoblast forms the fascial system of the body. From the nature of its development, obviously the connective tissue system of the body, which forms fasciæ and septa, must form a continuous sponge work of sheaths, each being in continuity with that of every surrounding structure. In view of the nature of the development of fasciæ, it is entirely arbitrary to speak of the fasciæ of Camper, Scarpa, and Colles as separate entities. They form one continuous sheet with some little difference here and there which has led to this profusion of names.

The description of the fascia of Camper as given in textbooks of anatomy admits of little addition. Camper's fascia is that portion of the subcutaneous fat in relation to a variable part of the lower abdominal wall, which is bounded on its deep surface by a well marked

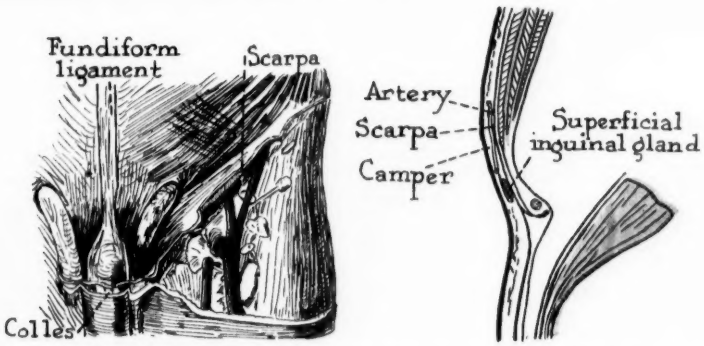

Fig. 1. a (left), A dissection from Cunningham showing the fundiform ligament of the penis and fusion of the fasciæ of Scarpa and Colles. b, Diagram of inguinal region showing the lymph vascular plane between the fasciæ of Scarpa and Camper (modified from Cunningham).

membranous condensation. It is continuous above and below with the general subcutaneous fat, but over penis and scrotum is replaced by unstriped muscle. Between Camper and Scarpa lie the superficial arteries and veins, such as the superficial circumflex iliac, the superficial inferior epigastric, and the superficial external pudendal vessels, also the lymph glands of the groin, which latter structures never transgress the inguinal ligament.

The best account of the relation of this layer to that of Scarpa is that which the writer heard Professor Wright of the London Hospital give in 1919. He stated that these fasciæ were inseparable over the lower abdomen except with the edge of a knife. He aptly compared them to a layer of surgeon's lint, that is to say, one layer in reality, the rough surface being Camper and the smooth surface being the membraneous layer of Scarpa. This description exactly fits the fasciæ over the lower abdomen, but over the base of the thigh they are easily separable because of the lymph-vascular interposition. That a cleavage plane exists here is of moment surgically in relation to the upward path frequently taken by a femoral hernia. (Figure 1b.)

Professor Wright then went on to say that such a condensation occurred elsewhere in the body: (a) the fascia transversalis being merely an external condensation of the extraperitoneal fat; (b) the capsule of Gerota being an internal condensation of the perirenal fat and ascribable to the effect of the pulsation of the kidney.

The dartos "tunic" is described by Gray as follows: "In the male, Camper's fascia is continued over the penis and outer surface of the spermatic cord to the scrotum, where it helps to form the dartos; as it passes to the scrotum it changes its characteristics, becoming thin, destitute of adipose tissue, and of a pale reddish color; in the scrotum it acquires some involuntary muscular fibers and forms the dartos tunic. From the scrotum it may be traced backward into continuity with the superficial fascia of the perineum." This account agrees with that of other British textbooks. The French anatomists seemed to have realized more thoroughly that this muscle is in reality very large and extensive and not the vestigial structure it is usual considered to be in English speaking countries (Fig. 2a).

The present research has shown that the muscle sometimes forms a complete investment for penis and scrotum. Displayed in a newborn male child, one is astounded by the extent of this muscle (Fig. 3).

Penile dartos muscle commences at the pubic aspect of the root of the penis as a definite layer of reddish muscle which blends here with Camper and fundiform ligament. It extends in longitudinally arranged muscle fibers to the very tip of the prepuce and invests the entire projecting portion of the penis.

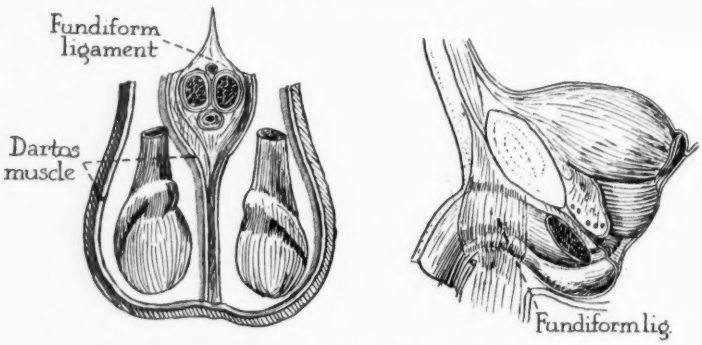

Fig. 2. a (left), Diagram from Testut showing the constituent parts of the dartos muscle and the fundiform ligament of the penis. b, The fundiform ligament seen from the side.

At the region of the third inguinal ring (*vide infra*) the yellow fascia of Camper suddenly changes to the red dartos, the scrotal dartos muscle. The transition is sudden and remarkable and well shown in Figure 3 taken from an actual dissection. The muscle completely invests the testis and its coverings except where the cord enters. It is big and powerful, its fibers are generally directed vertically in the long axis of the testis. The fibers arise from the skin on one side and are inserted into the septum of the scrotum or the layer of the fascia of Colles which covers the testis. Many of the fibers extend right round the longest circumference of the testis. The observer was profoundly amazed on first displaying the structure shown in Figure 3. That it possesses an important supporting function cannot be questioned. There are two layers of dartos in the scrotal septum, one from each testicular compartment. In the adult one usually sees an incomplete layer of pinkish fibers irregularly scattered over the testis. The dartos muscle can often be displayed over the adult penis. It is not usually looked for here. The muscle supports the testis and scrotum as a hammock and wrinkles the skin over the scrotum. This account applies to the dartos muscle and not to the subjacent membranous layer of superficial fascia. The dartos is in series with Camper's fascia and the subcutaneous fat on the perineum and bears the same relation to the subjacent fascia which Camper does to Scarpa. The simile of surgeon's lint is still applicable to the two layers of superficial fascia over penis and scrotum.

The dartos has as its deep relation a thick, strong, membranous sheet of fascia continuous with the fascia of Colles below and that of Scarpa above. It will be shown later that this fascia is in all respects similar to the fascia of Colles rather than to that of Scarpa, and it should be included as a part of the former, although all three are continuous with each other. It should be emphasized that this is an entirely different structure to the dartos muscle despite their intimate relation and blending, and the term "dartos tunic" should be understood to represent two important penile and testicular coverings, the outer muscular, the inner membranous.

The fascia of Scarpa will be considered in great detail as it is one of the most important structures investigated in this research. The account given of it in different standard textbooks of anatomy and surgical anatomy are so similar that comparing or contrasting is unnecessary. The main points about the fascia as classically described are as follows:

Toward the lower part of the abdomen the panniculus adiposus develops a deep membranous stratum containing much elastic tissue. It is a relic of the elastic tunic of the lower animals such as the horse. In the region of the pubis it is carried continuously downward over the spermatic cords, the penis, and scrotum, into the perineum where it becomes continuous with the fascia of Colles, which is

attached on each side to the corresponding body and ramus of the pubis. On the lateral side of the spermatic cord in the region of the groin, Scarpa's fascia ends immediately distal to the inguinal ligament by blending with the fascia lata of the thigh (Fig. 1a).

According to Burdick and Coley the testis and cord pass down into the scrotum in front of the fascia of Scarpa and behind that of Camper, i.e. between the two layers of superficial fascia. This is entirely contrary to all accepted anatomical teaching. The following description is based on the writer's researches:

Sir William Turner on being asked by a student where the sympathetic began, frightened him out of his wits by roaring in his deep voice "The sympathetic begins nowhere." Something of the same sort may be said of the fascia of Scarpa. Its upper limit shades so gradually into the subcutaneous fat that one cannot say exactly where it starts. It is certainly most variable in its extent upward and the degree of its development. Sometimes it may be traced well above the umbilicus. Laterally it disappears in a similar fashion in the region of the loins.

In color it is bluish or grey and in well covered specimens and babies its fibers may be seen separated by much fat and fibrous tissue. In these characters it differs from the fascia of Colles which is whiter, thicker, and has no fat. The fascia over the penis and scrotum in series with these fasciæ conforms to the description of Colles' fascia and should be so called.

Scarpa's fascia may be said to extend (1) medially, to fuse with the fundiform ligament of the penis; (2) distally (a) to the neighborhood of the root of the penis, where it fuses with the fascia of Colles—(b) to the third inguinal ring, where it fuses with Colles; and (c) to the fascia lata and pubic bone, as will be described. The fascia has no relation to penis and scrotum other than above described, unless Colles' fascia be considered merely as a name for a part of Scarpa's.

Over the lower linea alba it blends with a mass of tissue, the fundiform ligament, which binds Scarpa to the linea alba, so that there is a septum here between right and left halves of the fascia. It has no attachment to the suspensory ligament of the penis.

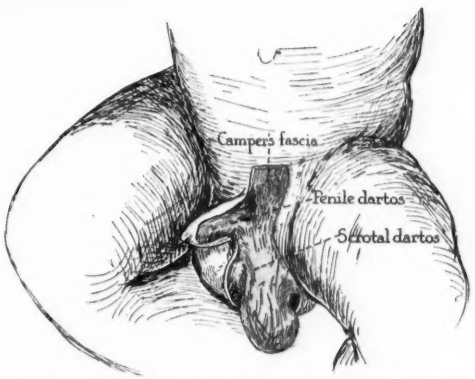

Fig. 3. Dissection of a newborn child showing an extensive dartos muscle, both scrotal and penile portions being perfect. The manner of replacement of Camper's fascia by the dartos muscle is shown.

An investigation of the relations and attachments of Scarpa's fascia at the root of the thigh discloses surprising facts of much practical importance in connection with ectopia testis. The attachments here are (1) lateral attachments, and (2) medial attachments—direct and reflected.

The arrangement of the lateral attachments is simple in the outer half. Here the fascia blends with the fascia lata a little below the outer half of the inguinal ligament. Quite as often it blends with the fascia lata actually where the latter meets the inguinal ligament (Fig. 1a). Frequently the most lateral attachment is to the fascia lata at the anterior superior iliac spine. This point is of some importance in connection with the position of the superficial inguinal ectopic testis.

In the inner half of its attachment at the root of the thigh, the fascia has medial attachments direct and reflected. As to the direct attachment, the fascia is attached just below the inguinal ligament in the region of the femoral vessels; its attachment then descends obliquely from the fascia lata to a point on the ischic pubic ramus about 2½ inches to 3 inches below the pubic spine. Along this line it blends with the fascia lata. Its attachment, therefore, crosses the femoral vessels, the adductor longus, and ends at the ramus on the gracilis expansion. The line of attachment crosses the fossa ovalis. The manner of crossing is variable. It may cross the upper or

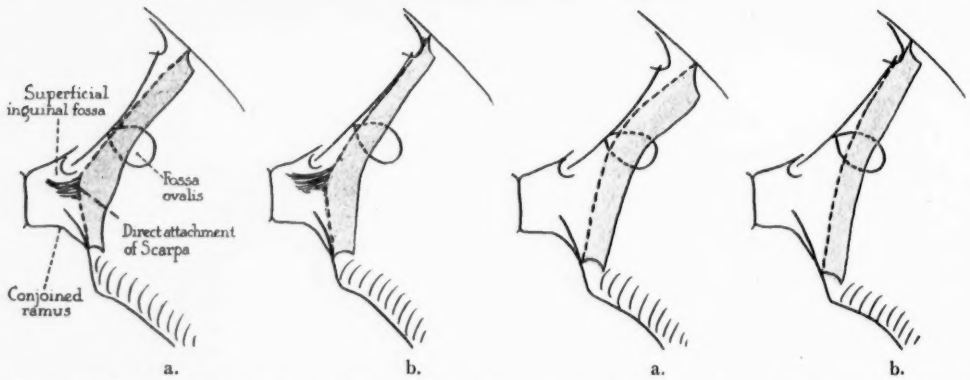

Fig. 4. A diagram showing the method of attachment of Scarpa's fascia in Types 1 and 2. Note the direct and reflected attachments and the variation in position of the outer part of the direct attachment; see variable relation of direct attachment to the fossa ovalis.

lower part of the fossa and obviously influences the relations of a femoral hernia. This point will be elaborated later (Fig. 4). It will be seen that the line of fusion of the inner portions of the direct attachment of the fascia of Scarpa with the fascia lata is much below that given in textbooks.

The inner half of the fascia is stated to be attached to the inner half of the inguinal ligament (25), whereas its line of fusion is often a variable distance below this point. The fascial attachment descends about 1 inch to 1½ inches below and lateral to the pubic spine. The great importance of this will be pointed out later. There is, therefore, frequently an area above this fascial attachment where 2 inches of the adductor longus tendon may be palpated. Injections under Colles' fascia in the perineum show this as defined above to be correct (Fig. 5).

What Burdick and Coley call the deep layer of the superficial fascia (Scarpa) of the lower abdomen, the writer ventures to call the reflected attachment of the fascia of Scarpa. Just as some fibers of the parietal layer of pelvic fascia end at the ischiopubic ramus, while others cross the pubic arch to form the superior layer of the urogenital diaphragm, so while some fibers of Scarpa's fascia gain a direct attachment to the fascia lata as indicated above, many of its fibers take a reflected course across the fascia lata, and while some are lost in the fascia lata, others blend with Pouparts ligament, others sweep across to fuse with the ligaments on the front of the body of the pubis, and still others pass in over the adductors and are attached to the pubic ramus. It will be seen that these fibers of Scarpa pass down on the anterior abdominal wall to the line of the direct attachment and then bend sharply inward toward the pubis. If this part of the fascia is to be called the posterior layer, it must be distinctly understood that by the anterior layer is meant the fascia of Scarpa passing down from the anterior abdominal wall and not the fascia of Camper as Burdick and Coley intend.

It is of great importance to observe that the fasciculi of the reflected attachment are directed horizontally for the most part. This reflected process while always presenting the same attachments differs in the appearance of its anterior surface. This difference is probably of profound importance in the etiology of ectopia testis.

In type 1 the reflected fibers sweep across to the pubis in a smooth unbroken line and the anterior surface of the process is flat and even.

In type 2 a fasciculus of the reflected attachment forms a definite ligament with an upper border which is usually horizontal but sometimes curved with its concavity upward and outward. Behind this border there is a depression which sometimes forms a definite fossa, which fossa is immediately below the outer part of the external abdominal ring.

Where this ligament (for simplicity called Scarpa's ligament) meets the direct attachment, there is formed an acute angle the sharpness of which is rounded off by certain arcuate fibers. Immediately above this angle the ilio-inguinal nerve pierces the fascia of Scarpa usually as one, sometimes as two trunks. The greatest interest attaches to this arrangement of the reflected process of Scarpa. The ligament extends horizontally to fuse with the ligaments on the symphysis.

Of 20 subjects this ligament was found strong and well marked and forming a definite ridge 26 times. In 8 cases the arrangement of the reflected attachment was smooth and even. In the remaining 6 the ligament was rather membranous and formed a well marked edge about ½ inch below the upper border of the body of the pubis. In three bodies type 1 was seen on one side and type 2 on the other. This is an important observation.

It was further observed that a strong ligament on one side was sometimes associated with a membranous one on the other side (20 bodies enable the region to be examined in 40 cases). Great importance is attached to the fact that in the case of newborn babies and fetuses examined in this investigation, the reflected process of Scarpa was type 2 in conformation. This shows that the ligament is present in the fetus and does not develop in later life as the result of such factors as strain or weight lifting or the pull of the testicle.

It is further to be noted that there was a definite dimple behind the ligament in such young subjects. In a 5 months fetus, this ligament was big, very strong, and bilateral, with a definite recess behind it. All this indicates that it is not a development of post-uterine life.

It is of vast and far reaching importance to notice that the reflected attachment of the fascia of Scarpa is behind the spermatic cord. Though faint and poorly marked at times, in most cases there is a strong process of Scarpa behind the cord. This is contrary to all accepted anatomical doctrines. Though nowhere referred to in anatomical books, reference to Figures 6 and 7 will show that the artists (who faithfully depicted dissections) represent portions of this reflected process of Scarpa passing

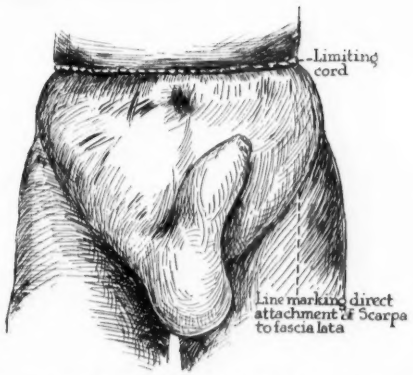

Fig. 5. An injection of red lead has been made under the fascia of Colles in the perineum. The direct attachment of Scarpa is well shown by the bulging of the superficial fascia. Penis and scrotum ballooned. Recently dead subject (24 hours).

behind the cord. Credit for this observation must go to Burdick and Coley, who, however, are wrong in the interpretation they place on it. Figure 8 borrowed from Burdick and Coley's article, shows the ligament formed by the reflected attachment of Scarpa with the cord passing anterior to it. This is correct. The author has never found the precise arrangement of the ligament which they figure, also they do not show the angle of fusion of the ligament with the direct attachment of Scarpa.

The scissors are in the pouch behind the ligament and in Figure 9 are shown in the areolar tissue over the adductors. They point out that anything pushed down behind the ligament would seem to enter the upper part of the scrotum, but in reality enters the root of the thigh between the ligament and the fascia lata over the adductors.

They also point out that it is impossible for anything entering here to enter the perineum. Entire agreement is expressed with this. It must be pointed out, however, that only by the use of considerable force or a sharp instrument can a passage be made behind the ligament. In all the cases examined where this pouch or ligament existed, there was found to be a strong fascial floor to the recess.

This floor is formed by the reflected attachment of the fascia of Scarpa. It is in view of these facts that the assumption made by Burdick and Coley that in crural ectopia the testis

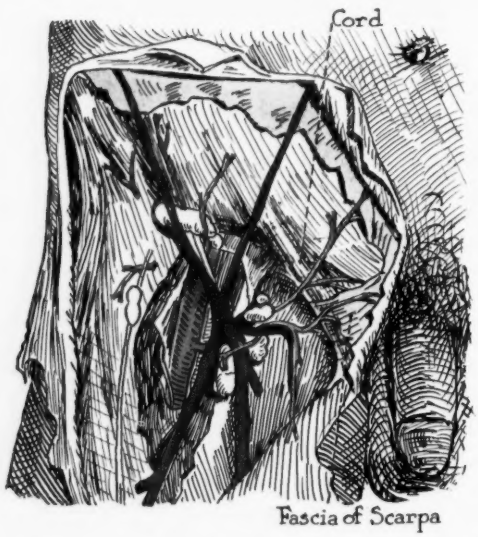

Fig. 6. Drawing taken from Quain, showing the fascia of Scarpa (green) winding round to the back of the cord.

passes down behind this fascia must be considered untenable. In Figure 10a they show the attachment of the fasciæ of Colles and Scarpa to the pubic ramus, stating that a testis under the layer of fascia joining the ramus on the reader's right cannot possibly enter the perineum. This is agreed. They do not show the direct attachment of the fascia of Scarpa, and from the drawing it would seem that the layer they call "the posterior layer of fascia" is the fascia lata of the thigh. The reflected layer in this situation has a similar attachment to the pubis which the fascia lata has and is superficial to it.

Figure 4 shows type 1 and type 2 arrangements of the reflected fascia as found in this research.

Before leaving the fascia of Scarpa we should point out that in type 2 of the reflected process, the ligament going behind the cord holds the direct attachment forward, angulating it, so that the line of attachment is sharply convex toward the pubic spine.

The fascia of Colles as usually described, is confined to the perineum, where it is attached to the ischiopubic rami and the base of the urogenital diaphragm (Fig. 11).

Cunningham states (conforming to all other descriptions) that toward the front of the perineum, the fascia of Colles is continuous with the Dartos tissue of the scrotum and that in its turn is continuous more anteriorly with the fascia of Scarpa. He states further that the bony attachment of Colles is prolonged upward as it becomes continuous with the fascia of Scarpa along the front of the symphysis pubis on each side. For reasons given above the writer considers the fascia of Colles to extend over the scrotum and penis deep to the dartos muscle.

Continuing, Cunningham states that the superficial pouch of the perineum is open above across the front of the symphysis pubis where its cavity is continuous with the areolar tissue filled interval between the superficial and deep fascia of the anterior wall of the abdomen.

Anteriorly the fascia of Colles passes over the scrotum, penis, and spermatic cords to the anterior aspect of the abdomen where it becomes continuous with the fascia of Scarpa. Note that Cunningham here definitely states that the fascia of Colles covers the genitals. The posterior scrotal vessels and nerves are immediately deep to this fascia. A more or less well developed septum dips down from the fascia of Colles to the inferior aspect of the bulb of the urethra.

The researches have shown some very important differences in the attachments of the fascia as described above and by other anatomists. The fascia will be described as consisting of two portions: (1) the general investing layer, and (2) the falciform process. Though this division is to some extent arbitrary, it is of great significance and valuable for descriptive purposes.

As to the general investing layer, from its nether attachment to the base of the urogenital diaphragm, the fascia extends up immediately under the subcutaneous tissue forming the lower wall of the superficial perineal pouch. Along a horizontal line a short distance above the head of the epididymis, the fascia is folded back on itself forming a well marked even ridge when the testis is dependent (the perineoscrotal reduplication). This ridge bounds the entrance to the cavity for the testis in front and

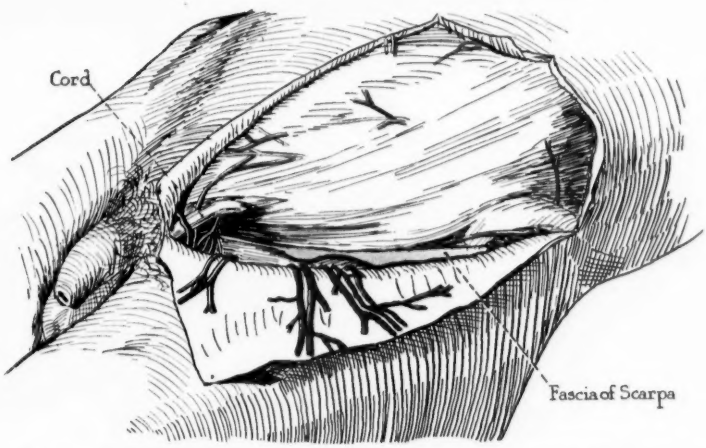

Fig. 7. A dissection from Ellis, suggesting a process of Scarpa's fascia passing behind the cord.

the superficial pouch of the perineum behind (Fig. 12).

The spermatic cord with its three coverings from the anterior abdominal wall lies anterior to this ridge to which the external fascia is attached. In the 5 months' fetus, the scrotum is the size of a pea and not dependent, yet there is a definite cavity in it for the testis to occupy when it descends, and the reduplication of Colles' fascia, though not an even ridge as in the adult, yet forms a definite shelf which the testis must cross (Fig. 18). Next, the fascia of Colles is reflected over the testicle and up on to the anterior aspect of the cord, becoming continuous with the fascia of Scarpa at the third inguinal ring and joining laterally with the fascia of Scarpa where it passes down to its direct attachment to the fascia lata.

The projectile portion of the penis is invested with a complete sheath of Colles' fascia as far as the base of the glans. On or in this sheath lies the superficial dorsal vein of the penis and underneath the fascia a fibrous stratum separates it from the dorsal vessels and nerves (Fig. 10b). On the ventral aspect of the penis, there is a septum binding the fascia of Colles to the fibrous investment of the corpus cavernosum urethræ. The fascia of Colles covers the projectile portion of the penis exactly as a finger stall open at both ends covers a finger (Fig. 12).

Where the suspensory ligament joins the penis the fascia of Colles presents different relations in the adult and the young child. In the adult the fascia is fused with the fibrous penile coat beneath it in the form of a ring around the organ. In the child the fascia of Colles is not bound down on its deep surface but fuses with the fundiform ligament of the penis, the two meeting at a right angle, and there is a passage for fluid to reach the anterior abdominal wall when it passes upward from under the penile portion of the fascia of Colles. In the adult it is questionable whether this can happen unless the fluid be under sufficient tension to break through the layer of connective tissue which binds Colles to the underlying fibrous stratum just in front of the suspensory ligament. If in the child the fusion of Colles with the fundiform ligament will be lifted or divided, the suspensory ligament will be seen unattached to either of the former layers (Fig. 14.) Passing from penis and cord to anterior abdominal wall the fascia of Colles fuses with the fascia of Scarpa.

Stress must be laid on the fact that the fascia of Colles which is superficial to the scrotal vessels and nerves and penile vessels and nerves is perforated in numerous places by small cutaneous branches of these.

As to the falciform process, the attachment of Colles' fascia to the conjoined ramus is not

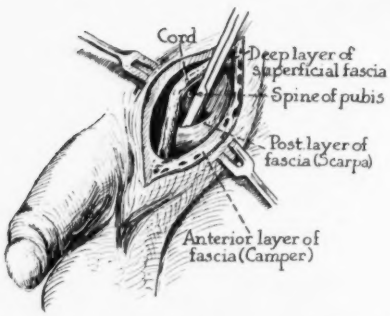

Fig. 8. Dissection from Burdick and Coley. The scissors shown in the superficial inguinal pouch. The ligament of Scarpa is in front of the scissors and not the general layer of Scarpa's fascia, as they have labeled it. What they label Camper's fascia is the general layer of Scarpa's fascia.

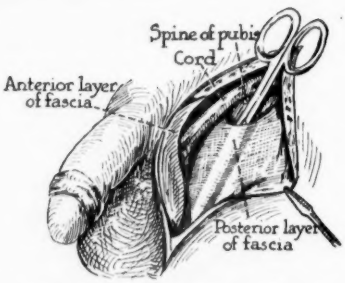

Fig. 9. From Burdick and Coley. The scissors have been forced through the floor of the superficial fossa into the tissues at the root of the thigh. A testis cannot possibly take this route.

confined to the lower part of this bone, but extends upward nearly to the inferior aspect of the symphysis. This is represented accurately in Figure 15b, which is reproduced from an old edition of Morris' *Anatomy* (1893). Figure 15a from Fraser's *Human Skeleton* (1914), shows but a small bony attachment for the fascia. This attachment forms a complete septum between perineum and thigh for half the distance from the base of the urogenital diaphragm to the pubic tubercle. Above this mid point the fascia of Colles sends a peculiar falciform process upward to the region of the symphysis and this falciform process is the only structure (when the testis with its coverings have been removed) intervening between the upper part of the superficial perineal pouch and the area at the root of the thigh above the direct attachment of Scarpa's fascia. This process forms therefore not a partition between the two areas but merely a ridge. This falciform process continues the line of attachment of Colles to the pubic ramus, which it leaves before reaching the angle of the pubic arch to cross the body of the pubis and to blend with the ligaments of the front of the pubis and particularly with the external oblique aponeurosis with the fibers of which it is often directly continuous (Fig. 16). This fasciculus of Colles is often composed of strong ligamentous fibers which seem by their size to have a supporting function as a sling for the scrotum. The falciform process is firmly bound by its anterior edge to the external spermatic fascia covering the cord. When this is removed by careful dissection it becomes a free edge. The writer has been much impressed by the constancy of this fascial process and by its apparently important function in regard to both the support of the scrotum and ectopia testis. It is this fascial process which bounds the tunnel from the superficial perineal pouch to the anterior abdominal wall on the outer side.

If the testis and cord with external spermatic fascia be removed it will at once be seen that the falciform process forms a raised ridge between the superficial perineal pouch and the compartment at the root of the thigh between the fascia of Scarpa and the fascia lata (covered of course by the reflected process of the fascia of Scarpa). The direct attachment of Scarpa reaches and fuses with the fascia of Colles at the pubic ramus just below the point where the attached margin of Colles gives off the falciform process. It will be apparent on referring to the illustrations of dissections shown here that there is a well marked pouch between the fascia of Colles and the direct attachment of the fascia of Scarpa where they fuse at the pubic ramus. This is the crural or femoral pouch (Fig. 16). It is remarkable how frequently the falciform process can be traced into the external oblique. Tendinous fibers of this muscle may be seen passing down into this process of Colles. Is it possible that the testis receives one of its main slings by insertion of external oblique into the fascia of Colles?

The falciform process was found particularly strong, well developed, and forming a definite ridge on both sides in a newborn child. Notice that the thin sickle-shaped edge forms but a very faint ridge above and a high prominent one in its lower part (Fig. 16). It would therefore be negotiated with ease above, but with great difficulty below. Notice also that this process is not apparent until the attachments of the external spermatic fascia have been separated from it, though arching fibers may be seen on exposing the envelopes of the testis and cord from their lateral aspect. The arching fibers will be seen close to the pubic ramus gaining an attachment to this bone. The dissection to expose the process requires meticulous care in its performance or else the reflected process of the fascia of Scarpa and the fascia lata over the adductor longus may be torn through, in which case the sheath of the adductor longus will be exposed, and the fibers of the fascia lata going to the body of the pubis, which have a longitudinal direction, may be mistaken for the falciform edge. However, on tracing these fibers down they will be seen to continue down the thigh and not to fuse with the fascia of Colles (Fig. 17). In one exceptional case certain fibers of the fascia of Scarpa were seen to cross the lower part of the falciform edge, passing down to gain an attachment to the testicular aspect of the fascia of Colles enveloping the scrotum. This was not found in any other case. So greatly did this falciform process intrigue the author that it was thought of the first importance to examine for it in fetuses at an age preceding the descent of the testis. The result of these dissections was further proof of the existence and function of the ledge. In the 5 months' fetus shown (Fig. 18), the falciform process was seen to form a definite vertical ridge separating perineum from crural region. It conformed exactly in miniature to the state in the adult and was better seen because the testis with its coverings had not descended to obscure the process. This part of Colles' fascia appears to be relatively stronger in the late fetus or early newborn child. Once again the strength and definition of the structure at so early an age would seem to bespeak for it some important function.

The deep fascia of the perineum. Reference to any textbook of human anatomy discloses the fact both in the textbook and in the illustrations of the perineal region that on the removal of the fascia of Colles, the muscles of the superficial pouch are exposed, some areolar tissue intervening (Fig. 11).

The author has repeatedly found that it is necessary to remove another layer of fascia before the muscles are reached. In this research this fascia has been found present in all cases, differing considerably in its development. At times the muscles are seen shining through it, but frequently it is very dense, strong and aponeurotic.

The deep perineal fascia blends behind the superficial transverse perineal muscle with the fascia of Colles and the urogenital diaphragm. It is attached at the sides to the ischiopubic ramus and extends on to the penis where it is continuous with a fibrous tunic of that organ, sometimes called the deep fascia of the penis. It, therefore, forms the first line of resistance which will be met by any extravasation of fluid deep to it. Near its base posteriorly it is sometimes perforated by the medial and lateral posterior scrotal nerves. Like the fascia of Colles it is perforated by small vessels in numerous places. Injections of a red lead solution made under the fascia extend on to the sides of the penis. The fascia confines the injection except where it is perforated by vessels and nerves, in which case it oozes out along these structures into the area just deep to Colles fascia.

It is bound down in the middle line on its muscular aspect to form a median septum. The author has called this layer the deep fascia of the perineum (Figs. 19 and 20).

The fundiform ligament of the penis. Morris describes this structure as arising from the linea alba and Scarpa's fascia just above the pubic symphysis. It forms a broad elastic band (superficial suspensory ligament of the penis) which sends a fasciculus on either side of the organ. Below the penis these fasciculi re-unite. Testut and others state that after this re-union the ligament continues down into the septum of the scrotum (Figs. 2a and 2b). The fundiform ligament has no attachment to the suspensory ligament of the penis.

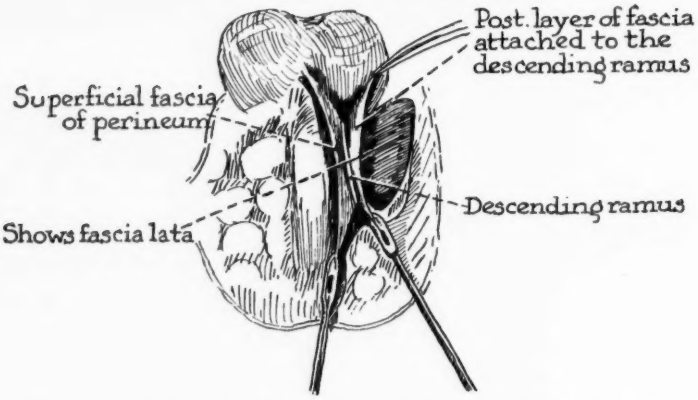
Post. layer of fascia attached to the descending ramus
Superficial fascia of perineum
Descending ramus
Shows fascia lata

Fig. 10a. From Burdick and Coley. Showing posterior layer of fascia (Scarpa) and Colles' fascia. The underlying muscle suggests the possibility of the fascia lata having been raised and not the fascia of Scarpa.

They are entirely separate structures. It is a large band of fibrous and elastic tissue firmly attached to the lower 2 or 3 inches of the linea alba and the external oblique aponeurosis. Some fibers of the external oblique end in it. The fascia of Colles, the fascia of Scarpa and some fibers of the penile dartos fuse with it. In the young child it is of considerable extent and thickness. There is no difficulty in tracing it round the sides of the penis as a broad flat band or in showing how it enters the scrotal septum below (Figs. 19 and 20). The relatively great size of this structure in very young babies is so striking that the relations of the ligament were examined with particular care. A discovery of great importance was made. In a 5 months' fetus the ligament was exceptionally broad and strong considering the diminutive size of the specimen. The ligament was as thick and as long as the penis, but the point of greatest interest was the finding of a well marked fossa in relation to the ligament. This existed only on the right side and was bounded below by the dorsum of the penis, anteriorly by the fundiform ligament which formed a shelf which projected laterally for 1/8 inch posteriorly by the ligaments on the front of the pubis, and medially by the fundiform ligament extending down to the anterior abdominal wall and pubis. Laterally the fossa was opened. This the writer has labelled the pubic fossa (Fig. 27a). Its importance will be referred to later.

The suspensory ligament of the penis is a strong band of tissue, somewhat triangular in shape, which is attached to the symphysis pubis on the one side and to the deep fascia of the penis on the other. The dorsal vessels and nerves divide its penile attachment into two halves (Fig. 14).

The ilio-inguinal nerve bears very constant relations to the subcutaneous inguinal ring and to the spermatic cord. Unless it reaches the thigh by some devious route such as incorporation in the lumbo-inguinal or lateral cutaneous nerve of the thigh, it invariably emerges lateral to the cord and passes for a short distance under the external spermatic fascia. It pierces the fascia of Scarpa as one or two trunks, carrying with it a strong sheath of external oblique through external spermatic fascia. When the reflected process of Scarpa's fascia sends Scarpa's ligament behind the cord this nerve is situated immediately above the angle of Scarpa. The pouch or recess above this ligament is bounded medially and above by the nerve with its sheath.

It is noteworthy that the ilio-inguinal nerve with its sheath forms a strong ligament immediately below and to the outer side of the subcutaneous inguinal ring, and also

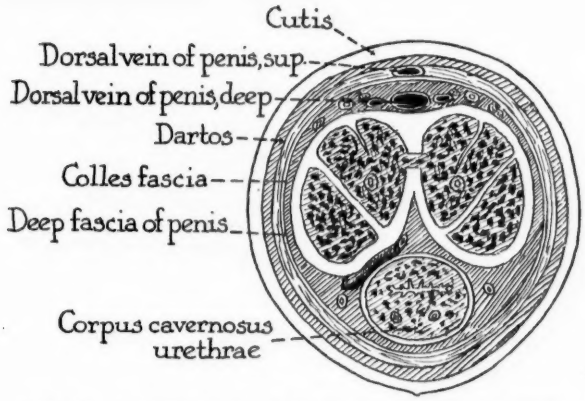

Fig. 10b. Transverse section of the penis showing the dartos muscle. Colles' fascia, and the deep fascia of the penis which is continuous with the deep fascia of the perineum. Note the position of vessels.

bounds the third inguinal ring just about its lateral margin (Fig. 25).

Only those coverings of testis and cord derived from the abdominal wall will be referred to here. These are the external spermatic fascia, the cremaster muscle and fascia, and the internal spermatic or infundifuliform fascia.

The external spermatic fascia is a prolongation of the external oblique aponeurosis which evaginated by the tunica vaginalis is its prolapse from the peritoneum. Usually described as a thin fascial layer subserving the function of ensheathing testis and cord, these researches amply demonstrate a much more active and important function for this aponeurosis. Figures 21, 21a, 23, and 27b show what would seem to be a constant finding.

Strong ligamentous fibers pass from the external oblique in the neighborhood of the external ring which gain a strong attachment to the fascia of Scarpa near the external ring. Strongly marked in the adult they are disproportionately larger and more powerful in the fetus and the newborn. These ligaments may be looked on as separate fibers of the external spermatic fascia, and they serve the important office of holding the superficial fascia close to the external ring and of directing the structures passing down from abdomen to testis. This is made clear by the next figure (Fig. 27b) which shows in a young fetus these fibers binding the superficial fascia to the external oblique at a stage preceding the descent of the gubernaculum. This is a surprising finding and indicates an important function for these ligaments.

As the third inguinal ring is immediately below the external inguinal ring it will be understood that the ligaments which are attached to the anterior margin of the third ring (which margin is movable) serve to hold the orifice up toward the opening in the external oblique, and also hold the third ring open, so that the descending structures, having negotiated the abdominal wall, prolapse directly into this gaping hole.

These ligaments apparently precede the evagination of the external oblique as shown by Figure 27b.

The external spermatic fascia proper is firmly attached in the whole of its extent to the surrounding coverings on its outer circumference. Therefore it attaches to the fasciæ of Scarpa and Colles and also to the falciform process of Colles and the reduplication of this layer at the junction of scrotum and perineum. Anyone who has tried to deliver the testis at operation without first dividing its coverings will realize how firmly the external spermatic fascia is attached throughout its course. This layer may be considered an important sling holding up the scrotum through the external oblique above on the one hand and the super-

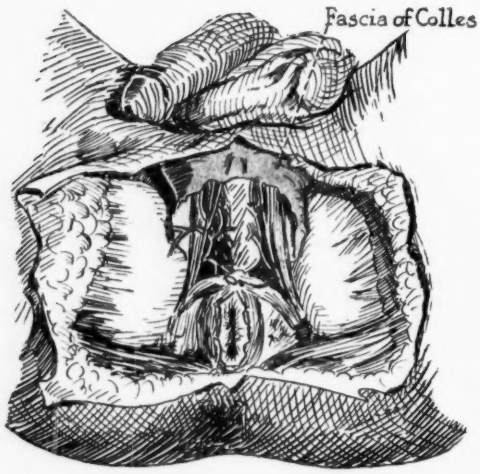

Fig. 11. Dissection from Quain showing Colles' fascia and no trace of deep fascia of perineum.

ficial fasciæ below on the other. Its inner surface is free and it is in this plane that the testis moves so freely up and down. It is this fascia also which is the main difficulty in defining the exact relations of the fascia of Colles.

The interesting cremaster muscle which arises in the angle between the lower border of the internal oblique and Poupart's ligament is inserted into the pubic tubercle, its fibers forming loops which descend over testis and cord. John Hunter, so justly honored for his great contributions to science, pointed out that this muscle would seem to serve as important a function in animals with testes normally abdominal, as in those whose testes become scrotal. He could not define this function, though he pointed out that in the former cases the muscle ascends behind the peritoneum to attach to the testis. In animals with scrotal testes it supports these organs and by the degree of its contraction determines whether the testes rest in the scrotum or higher. In children its excitability frequently causes mistakes in diagnosis, as the testis may be pulled temporarily into the subpubic region.

Hunter also pointed out that this muscle is much hypertrophied in people with a hydrocele of the tunica vaginalis testis.

A wrong impression of the size of the muscle is often obtained at operation where only a small part of it is exposed. It then appears to be represented by a few discrete muscle fibers. When fully exposed in the postmortem or dissecting room, it is seen to be a large muscle (Fig. 22).

Little will be said about the internal spermatic fascia, except to point out that it is laminated and two or more layers may be divided before the structures it encloses are exposed. This was first pointed out to the writer by Professor D. P. D. Wilkie.

The slings of the scrotum. By the liberality with which nature has supplied the scrotum with supporting bands and ligaments, it would almost seem as though a far seeing Providence were providing so profuse a system of supports to prevent undue sagging should the scrotum have more to sustain than the testis. This occasion arises often enough whether the cause be a rupture, a collection of fluid, a granuloma, or a tumor. These slings are derived entirely from the superficial fascia assisted by the external oblique.

1. The scrotal dartos by its continuity with Camper's fascia and the manner in which this muscle surrounds the scrotal part of Colles' fascia, acts as a muscular hammock.

2. Scarpa's fascia holds up the scrotum by means of (a) its fusion with Colles in the region of the third ring, (b) the direct attachment of Scarpa to Colles where they meet at the pubic ramus, (c) the occasional fasciculus of the reflected attachment of Scarpa described above, (d) the fundiform ligament which is an important support for the septum of the scrotum.

3. Colles fascia. The falciform process acts as a strong ligament suspending the fascia of Colles from the pubis and anterior abdominal wall.

4. The external oblique. (a) The ligament binding this muscle to the fascia of Scarpa at the third ring, (b) the ligamentous fibers of the external oblique which pass down into the falciform process of the fascia of Colles, (c) the very strong support supplied to the scrotum by the diffuse manner in which the external spermatic fascia fuses with the fascia

of Scarpa, the fascia of Colles and its falciform process.

Anatomical pouches normally found in the genital region. One of the foremost results of this investigation has been the discovery of certain pouches, detailed hereunder, which the author thinks to be of profound interest and practical significance.

The superficial perineal pouch is known to everyone. Burdick and Coley say: "By inserting the fingers behind the posterior layer of the superficial fascia (the fingers actually passing behind the ligament of Scarpa, as has been indicated above) they enter a space of loose tissue which gives the impression of being in the scrotum, while actually the fingers are in the loose areolar tissue of the upper and inner thigh." These remarks are applied to the normal cadaver. This is the only reference made in the literature to a recess which might misdirect the testis in its descent. It has been pointed out above that there is sometimes, in fact in about 50 per cent of cases, a more or less well defined pouch in this situation.

There are in and about the genital region five pouches: the pubic pouch, the superficial inguinal pouch, the crural or femoral pouch, the perineal pouch, and the scrotal pouch. Three of these are always present, one is frequently present, and the remaining one has only been found in a 5 months' fetus.

The pubic pouch was found on one side in a dissection of a 5 months' fetus. It is shallow and lies just to one side of the mid line over the pubic bone (Fig. 27a).

The pubic pouch is bounded anteriorly by a projecting shelf of the fundiform ligament and lateral to that of Scarpa's fascia—this shelf caused a projection much like that formed, by the peritoneum which forms the anterior wall of the paraduodenal fossa, and which contains the inferior mesenteric vein in its free edge.

Posteriorly by the ligaments on the front of the pubis and the external oblique.

Medially by the fundiform ligament.

Laterally the fossa is open, and the external abdominal ring lies close to the open wall of the fossa.

Superiorly, the fossa tapers to a point where the fundiform ligament meets the linea alba.

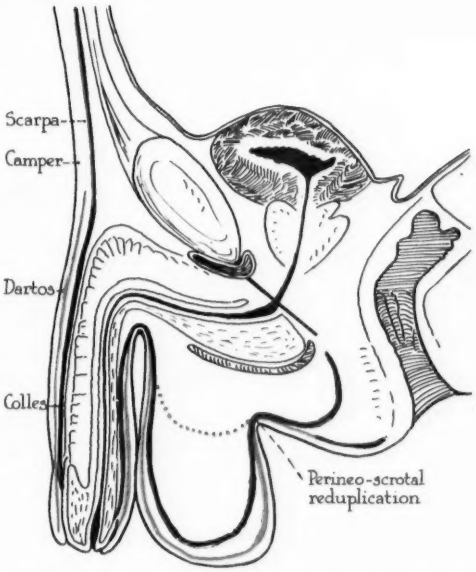

Fig. 12. Diagram showing longitudinal section of penis. Note the perineoscrotal reduplication in adult and fetus (dotted line). The fascial planes and relations are indicated.

Inferiorly, by the dorsal surface of the root of the penis. It is in this situation that the fundiform ligament blends with the fascia of Colles.

The superficial inguinal pouch was found in 26 of 40 cases. It may exist on one side and not on the other. It may be well marked on one side and slightly so on the opposite side. It may be well developed or absent on both sides.

It can exist only when a fasciculus of the reflected attachment of Scarpa's fascia forms a definite ligament (Scarpa's ligament). It has been shown above that this ligament usually has a horizontal upper border, though it is sometimes curved with its concavity upward and outward. The fibers of the ligament blend with the tissue on the front of the pubis, the border fading away about half an inch from the mid line. The length of the ridge is about an inch if well marked, but is often less. It may be membranous or strong and ligamentous.

It was well marked in the subjects before or just after birth, giving the impression that the

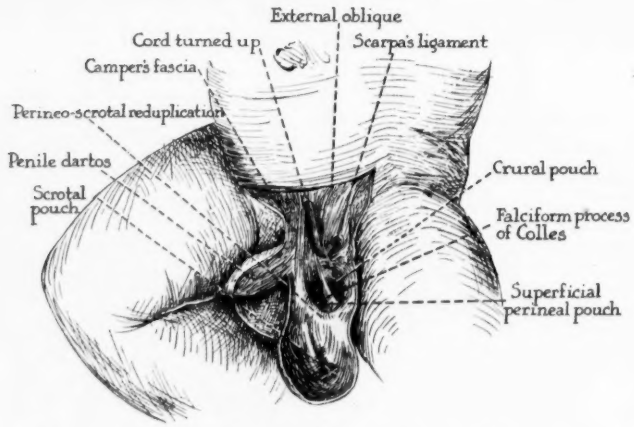

Fig. 13. Dissection of newborn child. See fascia of Camper, dartos, ligament of Scarpa, falciform process of Colles and pouches.

fetal development exceeded that in the adult. The fossa is shown in Figures 17, 18, 27a, 27c, and others.

It is situated below and also lateral to the pubic spine, the external inguinal ring, and the inner portion of Poupart's ligament.

The superficial inguinal pouch is bounded anteriorly by Scarpa's ligament formed by certain of the reflected fibers of Scarpa's fascia.

Posteriorly by the reflected fibers of Scarpa's fascia going to the inner part of Poupart's ligament over the fascia lata.

Medially, the fossa tapers to a very acute angle, where the ligament blends with the pubis. The ilio-inguinal nerve crosses above the floor of the fossa.

Laterally, the fossa opens by a mouth which is the widest part of the fossa. Great emphasis attaches to this point and to the fact that this outlet opens into a gutter formed by the fusion of Scarpa's fascia with the fascia lata and Poupart's ligament. This gutter has a smooth, even, unobstructed floor which runs outward with a slight upward inclination to the anterior superior iliac spine.

Inferiorly, the floor of the fossa is formed by fibers of the reflected attachment of Scarpa, which go to their inguinal and pubic destinations, and which, though in series with Scarpa's ligament do not project as it does, so that the fossa results. This floor forms a strong fibrous area through which nothing can pass unless cut or other violence is used. The fact is again stressed that no case has yet been seen by the writer in which the finger could be passed behind the ligament through the floor of the fossa unless great violence was used. An easy way behind the ligament, which Burdick and Coley found, has never been found during this research. Although an instrument pushed through the floor of the fossa passes to the root of the thigh and not to the perineum, as pointed out by Burdick and Coley, the writer cannot conceive that a misdirected testicle could pass through the floor of the fossa.

Superiorly, the pouch is open upward as well as outward. It may present the appearance of a small slit or of quite a wide orifice. The important practical point is that just above the fossa is found the pubic tubercle, the external inguinal ring, and the medial end of the inguinal ligament. This fossa like the pubic one is situated immediately behind the deep layer of the superficial fascia of the anterior abdominal wall.

The position of the crural or femoral pouch is difficult to describe in words, but immediately apparent in the drawings taken from the actual specimens. (Figs. 13, 16, 18, 26, etc.) It is remarkably constant in relation,

structure, and situation. It was noted above that the direct attachment of Scarpa's fascia in the thigh passed down with an oblique trend inward to meet the ischiopubic ramus and the fascia of Colles at a point just below the origin of the falciform process from the fascia of Colles, this point being about 3 inches or less from the pubic tubercle. It is exactly here that the pouch lies.

The crural or femoral pouch is bounded anteriorly by the fascia of Scarpa coming down as the deep layer of superficial fascia to the inner end of its direct attachment.

Posteriorly, by the lower most reflected fibers of Scarpa going to the ramus and coursing over the fascia lata where it covers the expansion of origin of the gracilis.

Medially, by the fascia of Colles where it forms the anterior wall of the outer part of the superficial perineal pouch. Note particularly that only this fascia separates the fossa from this perineal compartment.

Laterally, by the angle between the direct and reflected attachments of Scarpa.

Superiorly, the fossa is open above into the wide area bounded medially by the falciform edge of Colles, and laterally by the direct attachment of Scarpa in its inner oblique part. The pouch may be likened to the apex of a V, Scarpa's and Colles' attachments just described forming the limbs of the V. The open limbs of the V would direct into the apex anything descending from above.

It is unnecessary to go into detail about the perineal pouch, by which is intended the universally recognized superficial perineal pouch. This pouch is bounded anteriorly by the fascia of Colles, which in the upper part of the pouch is reduplicated to form the shelf which leads into the scrotal pouch.

Posteriorly, by the deep fascia of the perineum covering the superficial perineal muscles and perforated by certain scrotal vessels or nerves.

Medially, the septum divides the pouch into two so that any solid structure entering this pouch from above, necessarily lies to one side of the mid line.

Laterally, by the fascia of Colles below, and its falciform edge above, which latter separates this pouch from the crural one.

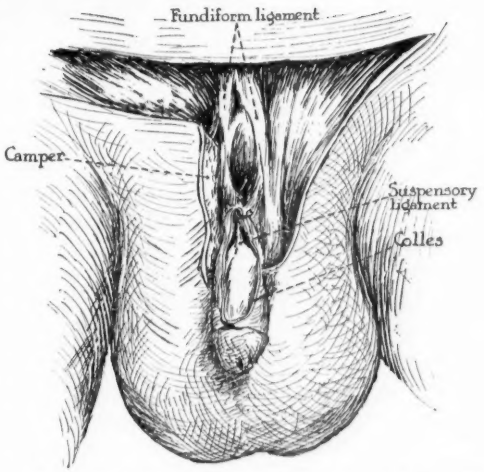

Fig. 14. Enlargement of a dissection of a newborn child showing the fascia of Colles becoming continuous with the fundiform ligament at the root of the penis. The arrow indicates a possible route for fluid. The suspensory ligament is shown below this right angled junction.

Inferiorly, the pouch ends by the fusion of Colles' fascia with the deep fascia of the perineum and the urogenital diaphragm.

Superiorly, the pouch is open toward the anterior abdominal wall, by a canal which traverses the third inguinal ring.

The perineal pouch contains the posterior scrotal vessels and nerves, perineal branch of the posterior cutaneous nerve of the thigh, and fat.

The scrotal pouch is the actual cavity containing the testis. Dissections of fetuses before the gubernaculum has descended show the pouch to exist at this early date (Fig. 27a). It is unnecessary to go into detail about the scrotal pouch, except to point out that its posterior wall just above the head of the epididymis turns sharply back on itself to form the inferior boundary of the superficial perineal pouch, i.e., the fascia of Colles, and that here is situated an even ridge dividing scrotal and perineal pouches. In front of the ridge is scrotal pouch, behind it is superficial perineal pouch. In the adult with the body erect, the angle formed by the meeting of perineal and scrotal portions of Colles' fascia is acute, in the fetus where the scrotum is not dependent, they form a right angle (Fig. 12).

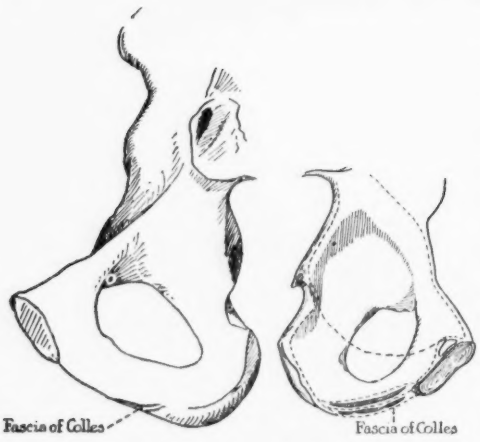

Fig. 15. a (left), Right os innominatum showing the extent of the fascia of Colles' attachment to the conjoined ramus according to Fraser. b, From an old edition of Morris's *Anatomy* showing a much more extensive attachment for Colles's fascia to the hip bone. This the present author thinks the more correct.

Observations of the first importance may be made in regard to the crural, scrotal, and perineal pouches. They are all constant, they lie very close together, and two ridges namely, the falciform process of Colles and the perineoscrotal reduplication of Colles are responsible for the formation of the fossæ.

This is well shown in dissections of all ages: adult, newborn, and fetus (see Figs. 13, 16, 17, 18, 24, 26, 27a).

The third inguinal ring. In the course of its hazardous journey from the posterior abdominal wall to its scrotal destination, the testis must first negotiate the narrow defile formed by the inguinal canal: this stage safely completed, it must cross a small strip of no man's land and then pass through a gateway which gives admittance to the scrotum. This gateway the author has ventured to call the third inguinal ring.

Passing reference has been made to this orifice in the foregoing. It is situated immediately to one side of the mid line and half to one inch below the horizontal level of the upper border of the body of the pubis and the external inguinal ring in the adult. In the fetus it is immediately below these structures.

A definite ring exists only in those cases in which the reflected process of Scarpa's fascia forms a well marked ligament. When this is absent the outer boundary of the ring is necessarily missing, giving the opening a funnel shape. The entrance of the scrotum presents, therefore, one or two varieties of conformation:

In type 1 (Figs. 23, 26, 27c) the size varies from 1 to 1½ inch from medial to lateral boundaries; from ½ to ¾ inch from anterior to posterior boundaries. It is circular or oval in shape. The plane of inlet is horizontal. It is bounded anteriorly by the fusion of the fasciæ of Scarpa and Colles which are here continuous with each other. Anterior to these, Camper is giving place to the dartos muscle.

Posteriorly, by the ligaments and bone of the pubic body medially, Scarpa's ligament laterally (when present). Behind this band is the superficial inguinal pouch. Running up over the inner part of this boundary is the upper portion of the falciform process of Colles' fascia.

Medially, by the fundiform ligament and the root of the penis. The latter forms a ledge especially noticeable in the fetus.

Laterally, is situated a well defined sharp edge formed by Scarpa's ligament. The angle formed by this ligament and the general layer of Scarpa's fascia which gives off the ligament is fairly acute. This acuteness is rounded off by arcuate fibers. Immediately above this angle is the ilio-inguinal nerve, which heightens the lateral boundary of the opening, a small gap intervening between nerve and orifice.

Particular attention is directed to the fact that this opening is not seen immediately superficial fascia is raised from anterior abdominal wall, as is done in hernia operations. Like the external inguinal ring, this one is apparent only when the external spermatic fascia is removed. Now this fascia is attached fairly generally to the circumference of the ring particularly in front, though but slightly behind.

The ligaments which external oblique gives to Scarpa's fascia (described above) are attached to the anterior margin of the ring,

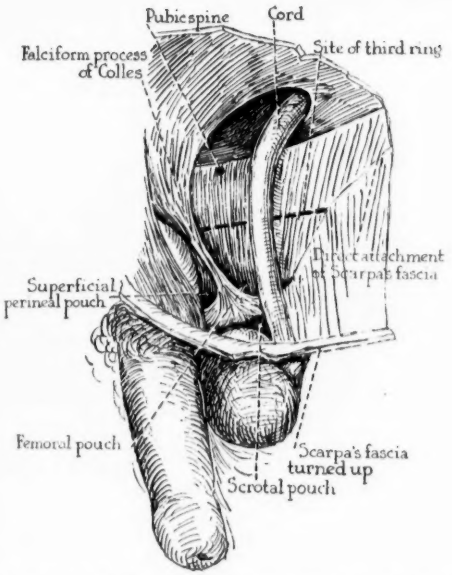

Fig. 16. A dissection showing the type 2 attachment of Scarpa's fascia. No ligament of Scarpa and therefore no superficial inguinal fossa exists. Note the relation of the cord to the pubic spine, the scrotal superficial perineal and femoral pouches. The dotted transverse line represents the site of the third inguinal ring—the funnel shaped type.

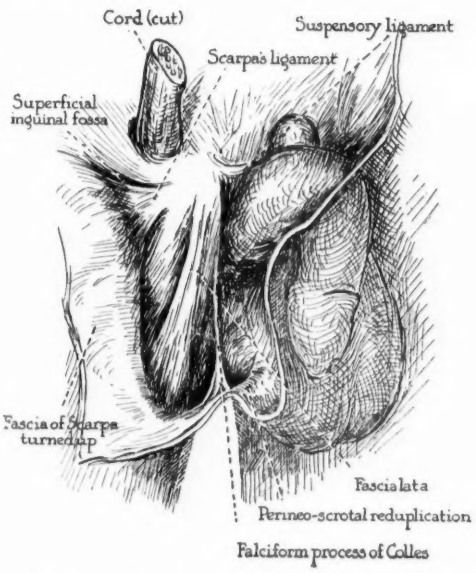

Fig. 17. A dissection. The fascia of Colles is reflected on the right. The reflected process is torn through below the ligament of Scarpa showing a process of fascia lata which might be mistaken for the falciform process of Colles which adjoins it on the left.

holding it up toward the opening in external oblique (Figs. 21, 21a, 27b). This is especially noticeable in babies and fetuses. Obviously these bands serve to hold open the orifice as well as to hold it up toward the external ring. Figure 25 is an actual drawing from a dissecting room subject in which the superficial fascia had been thrown down by the dissectors working in that region. Though a strong ligament is seen behind the cord and a well marked third ring exists, it is not the ring shown in the picture. The external spermatic fascia has been torn from the external ring, but is attached to the third ring below, and it is this attachment which shows as a ring in the drawing.

This, of course, is an artefact and is reproduced here to point out how an error may arise in defining the ring.

If now the external spermatic fascia be separated the third ring will come into view.

As to surface marking, this opening is represented in the adult by a horizontal line drawn outward from the middle line for an inch to an inch and a half to a level three-quarters inch below the pubic tubercle.

Clinically, a finger invaginating the scrotum to feel the external ring, passes through the third ring, the boundaries of which may be defined thus: Medially is root of penis and suspensory ligament, and laterally the ligament of Scarpa or the "gutter" alluded to. The cord is often felt lying in this gutter. When the neck of the scrotum is palpated clinically, the soft silky skin of this structure will be found to change abruptly at the upper part of the scrotal neck to the thick elastic skin of the lowermost part of the abdomen. This difference is still more apparent when the scrotum is invaginated through the third ring. The site where this abrupt transformation occurs is the third inguinal ring, and here Camper gives place to dartos and Scarpa gives place to Colles.

In the adult these are the structures passing to and from the testis together with the cover-

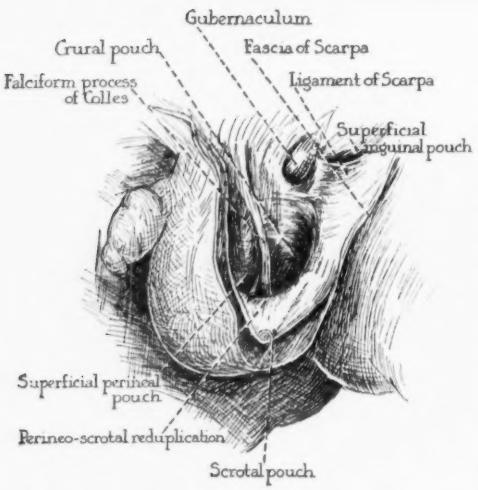

Fig. 18. Dissection of a 5 months' fetus. Note the gubernaculum which has evaded the superficial inguinal pouch. See also the crural and superficial perineal pouches and a well marked scrotal pouch (largely cut away) though the testis has not left the external ring.

ings they derive from the abdominal wall. In the fetus before the descent of the gubernaculum, the ring is well formed, patent, held widely open by ligaments from external oblique, and is empty (Fig. 27c). Observe that this orifice leads not only to the scrotum but also to the perineal and crural pouches.

In type 2 the ring is funnel shaped. In this variety the entrance to the scrotum is wider as the lateral crus of the ring (Scarpa's ligament) is absent. The other boundaries are the same. Laterally there is the gutter formed where the fascia of Scarpa gains its direct attachment to the fascia lata of the thigh. Therefore, instead of there being a prominent sharp margin here, there is a gently sloping gutter. There is here no ledge to deflect outward anything solid which is trying to enter the scrotal gateway from above. On the contrary, the lateral gutter would tend to direct any such body into the scrotum. This type of opening is shown in Figure 16.

The gubernaculum testis or chorda gubernaculi has received an amount of attention out of all proportion to its size and possibly to its importance. It is not a part of this research to deal at length with this body. It is alluded to mainly because it has been held almost universally to play a major part in the normal or ectopic descent of the testis. John Hunter, in 1762, gave this title to the tissue under consideration, and gave the first account of it, being stimulated thereto by a case which his brother encountered of a 7 months' fetus with abdominal testes. Neither of these two could explain the fact, and thus his research was incepted. He was further stimulated by the publication in 1755 of Baron Haller's *Opuscula Pathologica*. Not the least monument to the collosal genius and scientific acumen of John Hunter is the fact that his account of the gubernaculum testis is still the best extant. Much work has centered around the subject and Keith, Berry Hart, McAdam Eccles, Coley, Mixter, Bevan, Gowers, Godard, Curling, Lockwood, and others have made valuable contributions to the subject. All that is known of fact was elucidated by John Hunter, and though many theories about and yet about have come and gone, Hunter's theory of the cause of non-descent is today once again the most popular one.

At the end of the second month of intrauterine life the gubernaculum appears. At that stage it is an actively growing cellular mesenchymal condensation.

Though no muscle is apparent at this stage, this tissue is regarded as being premuscular (36). Striped and unstriped muscle fibers replace this tissue. The gubernaculum is then triangular, base above, apex below, the fibers being directed in its long axis. The apex is credited with the ability to excavate a path for the testis. Figure 29 is reproduced from Hunter's original one. According to some it grows rapidly through the inguinal region; according to others the inguinal canal is formed round the gubernaculum. It was Lockwood in 1887, who postulated a subdivision of the structure into six tails after its emergence at the external ring. One of these went to the scrotum, the others going one to each of the commoner sites of the ectopic testis. Though most ingenious, there is no corroborative evidence embryological or anatomical to support this contention (31). Others say definitely that these tails exist normally at one stage of development (15, 36).

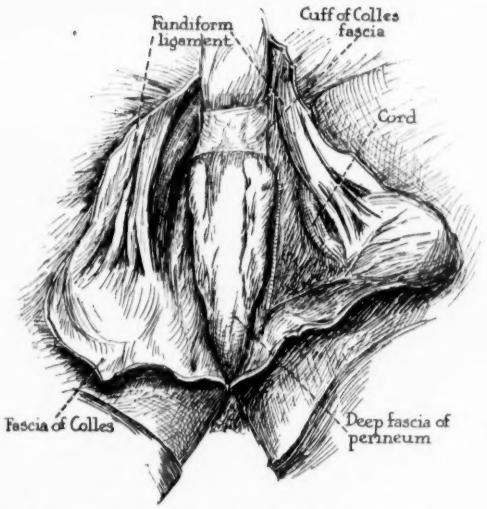

Fig. 19. Dissection of perineum. Note the deep fascia of the perineum with red lead injection under it.

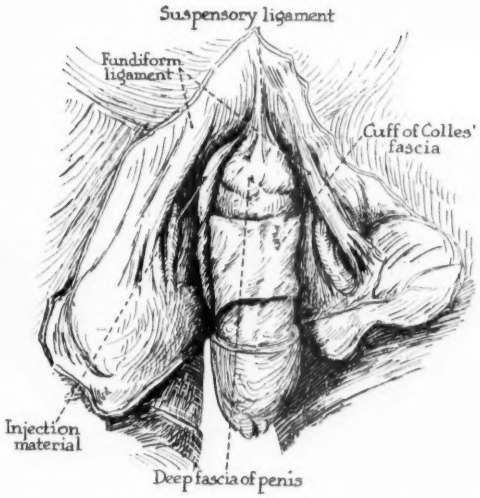

Fig. 20. Dorsal view of dissection shown in Figure 19. Note injection material spreading along crus penis under fascia of penis.

As the theory serves to explain the otherwise inexplicable it is generally used for teaching. Lockwood in support of this theory says: "It is irrational to deny this element its function, namely, that of contraction."

In searching for this structure or its remains in the adult one may find a nodule of tissue incorporated with the lower pole of the testis and its tunica. Just as often nothing is found. In cases of ectopia there is frequently tissue attached to the testis which is taken to be the gubernaculum. Such a structure unquestionably exists, but it is seriously open to question if it performs the functions so long accredited to it. In a 5 months' fetus an extremely interesting condition of the apices of the gubernaculum was found. On the left the structure had emerged from the external ring and its apex had surmounted the hither wall of a well marked superficial inguinal pouch. On the right it was not quite so far advanced and the delicate apex was arrested in the right superficial inguinal pouch. These conditions are shown in Figures 27a and c, and will be referred to later.

The spermatic cord is usually described as passing over the pubis on its way to the scrotum (2). In surgical textbooks the relation of inguinal and femoral herniæ to the pubic spine is one of the chief points in the differential diagnosis between these two types of rupture (34). "The most reliable method of differentiation (between femoral and inguinal hernia) is to recognize that the neck of an inguinal hernia lies above and medial to the spine of the pubis, while that of a femoral hernia lies below and lateral to the spine."

Discussing this classical statement Souttar says: "This statement does not, however, rest on a very secure basis of anatomical fact, for an examination of any normal male will show that the spermatic cord either crosses the pubic spine or lies external to it, crossing the inner extremity of Poupart's ligament, and this remains the natural position of an ordinary oblique hernia. It is, however, true that the pubic spine is most readily palpated from the outer side of an inguinal hernia, by displacing the latter inward and upward, and from the inner side of a femoral hernia." The writer, since reading Souttar's article, has been at pains to investigate this point. He can amply corroborate the truth of the statement.

In every one of the cases examined during this research, the cord was situated lateral to

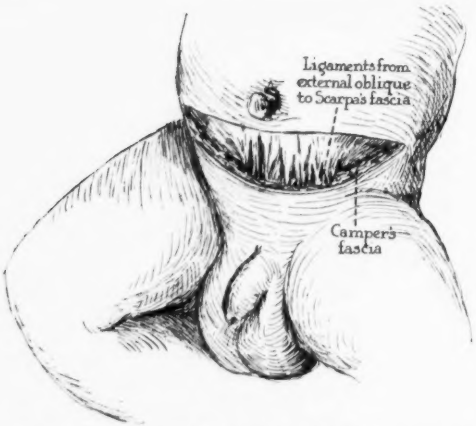

Fig. 21. A newborn child; showing fascia of Camper and the ligaments passing from the external oblique to fascia of Scarpa and the third inguinal ring.

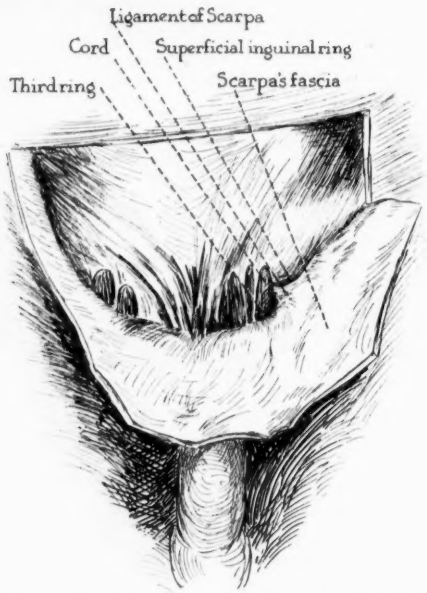

Fig. 21a. Dissection in the adult showing Scarpa's fascia turned down and numerous ligaments passing from external oblique to this fascia. On the left the ligaments are coursing over the cord to margins of the third ring.

the pubic spine. In no case was it medial. In babies it lay immediately outside the tubercle, in adults usually ½ inch lateral to this prominence (Fig. 16).

If it be remembered that the inferior crus of the external ring is formed by the inguinal ligament and is horizontal, it will be easily understood that the testis on emerging from this orifice will tend to pass down over the inferior crus. On the living subjects, clinical observation bears out these facts.

PATHOLOGICAL AND SURGICAL OBSERVATIONS

The anatomical findings stated in the foregoing gain their chief interest because of their practical applications. Certain surgical conditions affected by these findings will be discussed here briefly or at length according to their importance and their relationship to the research.

Extravasation of urine. Thomson and Miles (35) state that in rupture of urethra at the common site—in front of, or through the anterior layer of the triangular ligament—the urine infiltrates the cellular tissue of the anterior part of the perineum, the scrotum, penis, groins, and anterior abdominal wall. It is prevented from passing backward by the attachment of the perineal fascia to the base of the triangular ligament; and from passing down the thigh by the attachment of the deep layer of the superficial fascia of the abdominal wall to the fascia lata, along a line a little below Poupart's ligament. This investigation has brought out a few points of interest in connection with extravasation of urine due to urethral rupture at the usual site.

Injections of a red lead solution under Colles' fascia in the perineum were made. A band was tied tightly round the abdomen at the umbilicus in males recently dead (24 hours). The spread of the material defined the distal and lateral attachments of Scarpa's and Colles' fasciæ. In many cases the outer half of the attachment of Scarpa in the thigh did not extend below the inguinal ligament and the anterior superior iliac spine. In other cases the attachment was a little below this line. The inner half of its attachment in the thigh stood out in relief and corresponded to the oblique downward and inward attachment described for the direct attachment of Scarpa (Fig. 5).

It is usually understood from anatomical descriptions that perineal extravasations extend underneath Colles' fascia. Experimentally it is found that though this occurs to some extent, it is overshadowed by the amount of infiltration of the cellular tissue which occurs. This is plainly indicated by the Edinburgh surgeons quoted above.

When dissecting a part injected in this way, it is found that the superficial tissues have a myxomatous jelly-like appearance, due to the amount of fluid in the tissue spaces. This agrees exactly with the state of affairs found when incisions are made for extravasation of urine. The knife cuts through ½ inch or more of sodden, boggy tissues before it reaches the collection under the deep layer of the superficial fascia. This fact accounts also for the frequency with which sloughing of superficial tissues occurs in these cases. The scrotum and penis are infiltrated in precisely the same way. The fluid is enabled to reach this superficial cellular tissue along the branches of cutaneous vessels and nerves, which have to pierce Scarpa and Colles to reach their destinations.

Injections under the deep fascia of the perineum (when this is well developed) are fairly well localized by this layer. Extending back to the base of the triangular ligament, laterally to the conjoined ramus, and forward on to the dorsum of the penis at the sides of the suspensory ligament (Figs. 19, 20). When a fair amount of tension exists under the fascia, the fluid may be seen squirting alongside the vessels and nerves which pierce the deep fascia of the perineum. (Posterior scrotal and small unnamed branches of perineal artery.) When the fascia is strong, if the urethra is ruptured proximal to it, and it itself is intact, it will be the first line of resistance to the fluid. As this increases it will reach superficial perineal pouch along vessels and nerve sheaths. In a similar fashion these structures will guide it to the subcutaneous cellular tissue, i.e. Colles, Scarpa, dartos, and Camper.

Herniæ and hydrocele. Indirect inguinal hernia is the commonest type of hernia. It may reach the scrotum on the first occasion of its descent, or only after it has existed some time as a bubonocele. Every surgeon must have been impressed by the fact that these herniæ frequently exist for many years without any great increase in size. Occasionally, particularly in the days before surgery became so aggressive as it now is, inguinal herniæ sometimes increased to enormous dimensions. These had "lost the right of domicile" (11). Such herniæ were never common and are interesting. If now the slow rate of growth of an ordinary indirect inguinal hernia be compared with the rate of growth of umbilical (adult type) and scar herniæ, it will be found that the rate of growth of the latter is very rapid by comparison. This is easily understood when it is remembered that the inguinal hernia is supported in the scrotum by two muscle systems and by the numerous slings which hold up this structure. It is likely that herniæ which have forfeited the right of domicile result from a developmental weakness in the scrotal supports. In cases of infantile and encysted herniæ the writer ventures to suggest that the peritoneal process which lies in front of the hernial sac or which the hernial sac invaginates is anchored to the third inguinal ring, having become adherent there for some unknown reason. It is known that the anchoring of the vaginal process occurs just beyond the external ring and this is also the situation of the third ring.

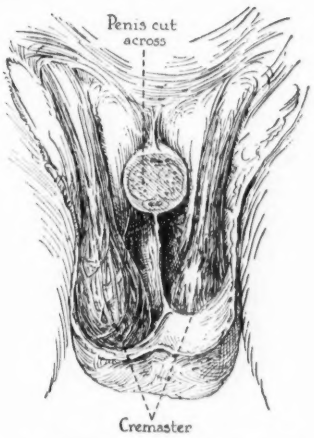

Fig. 22. A picture from Spalteholtz showing the cremaster.

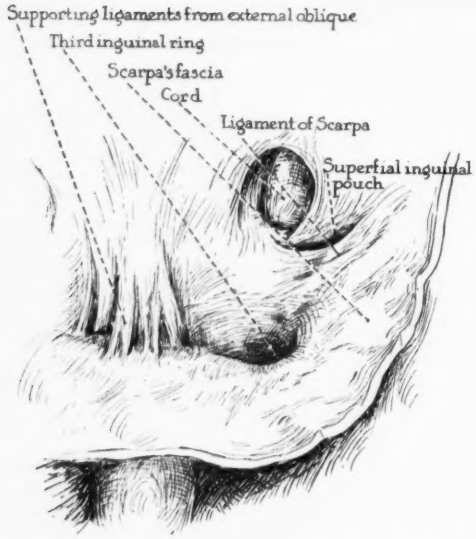

Fig. 23. Dissection of an adult. Note the third inguinal ring. Type 1, circular.

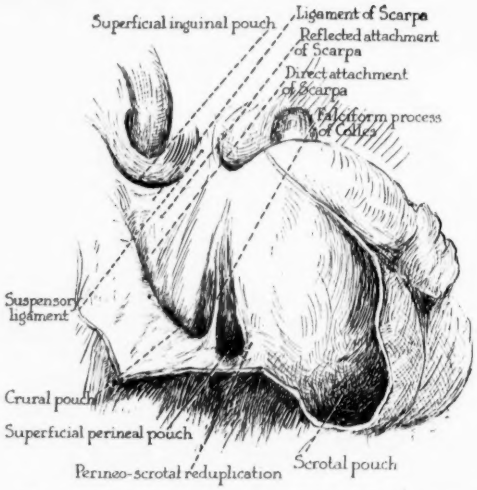

Fig. 24. Dissection of an adult. Note falciform process of Colles, Scarpa's ligament, direct and reflected attachments of Scarpa's fascia, and the constant pouches.

Direct inguinal hernia is not common and remains a bubonocele almost invariably. In the rather rare event where such a hernia reaches to the scrotum, it is of the type which leaves the abdomen lateral to the obliterated hypogastric artery, and it must, to get into the scrotum, prolapse into the large sac of a pre-existent extensive indirect hernia. This combination of events must be excessively rare. If the rupture does not manage to enter such a sac the reason why it remains outside the scrotum is probably that it cannot negotiate the third inguinal ring, being prevented from so doing by the size of this orifice and its normal contents. The falx inguinalis also acts as a deterrent.

A rupture leaving the abdomen through the femoral canal, tends, when it attains a fair size to extend in an upward direction along the line of the superficial inferior epigastric vessels over the inguinal ligament. This is the classical description given, the reason adduced being that this is the line of least resistance.

This ascent is between the fascia of Camper and that of Scarpa. Now it is a well known fact that these herniæ though they may attain the size of an orange, usually remain small, which is one of the difficulties in their diagnosis. Reference to Figure 4 will show that the line of the direct attachment of Scarpa's fascia usually crosses the fossa ovalis obliquely from above downward and inward. There would seem on anatomical grounds to be two possible routes which might be taken by a femoral hernia which has reached the saphenous opening: (1) the hernia may pass above this oblique line and would then push the fibers of Scarpa which are reflected toward the pubis before it; it would then be compelled to pass upward and outward in the gutter between the direct and reflected attachment of Scarpa's fascia. Such a rupture would ascend gently upward and outward and would have two layers of Scarpa's fascia in front of it, the deeper being a reflected process of Scarpa, the more superficial layer being the deep layer of superficial fascia (Scarpa). This hernia would have a tendency to remain small because of the resistance offered to its growth by these strata. Once, however, it reaches the gutter it will be prevented from extending downward by the same reason which prevents the fluid extravasated under Colles from extending down the thigh. (2) The hernia may appear below the oblique attachment of

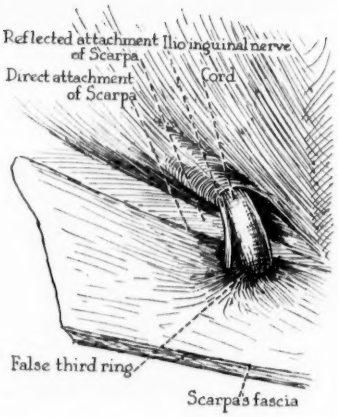

Fig. 25. A student's dissection showing a false third ring.

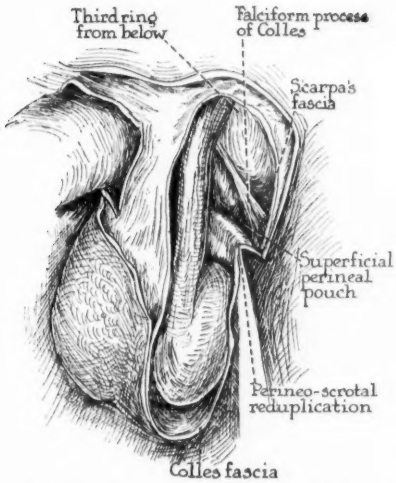

Fig. 26. Dissection in an adult. Note third ring from below. See falciform process of Colles, perineoscrotal reduplication and pouches. The inversion of the testis is artificial.

Scarpa crossing the saphenous opening. It is probably this type of case in which the swelling follows the superficial inferior epigastric. Here there is no fascia of Scarpa in front of it, and there should, therefore, be less resistance to its increase in size.

In hydrocele, hæmatocele, tumors of the testis, in all of these conditions the scrotum has frequently to support a considerable weight. In spite of this it does not hang very low, and also even in large hydroceles, the apex of the swelling passes as a rule through the third ring. It was in cases like these that Hunter found the cremaster hypertrophied. This is further evidence of the supporting function of the muscles and slings of the scrotum and also of the efficiency with which they carry out their functions.

The etiology of varicocele like that of varicose veins is unknown. It is thought that some congenital weakness of the veins exists. One of the characteristic features of the condition is that the testis hangs very low on the affected side, another is the frequency with which it affects young adults soon after puberty, the third is the occasional presence of severe neuralgic pains. It is found that the dartos muscle is lacking in tone. The writer would suggest that either the testicular supports are developmentally inefficient or that the scrotum is slung too low, either conditions resulting in a constant drag on the cord and on the pampiniform plexus. This would result in stagnation of blood and dilation of veins; it would also cause dragging on the ilio-inguinal nerve which runs inside the cord for a short distance below the external ring. In this way pain in the distribution of the anterior scrotal nerves may be accounted for.

Nothing has been found in this research to account for the usual lower situation of the left testis or to explain the great preponderance of varicocele on the left side.

Ilio-inguinal neuralgia. This is a rare condition. It does sometimes occur as a complication of varicocele. The pain radiates in the distribution of the nerve, i.e. upper part of scrotum and upper and inner thigh. The explanation given above is that the relatively unsupported testis in varicocele is more dependent and pulls on the nerve which runs inside the external spermatic fascia for ½ inch. In cases of ilio-inguinal neuralgia, apart from varicocele, it is possible that some small degree of traction may be responsible.

The imperfectly descended testis. The publication of Baron Haller's *Opuscula pathologica* in 1755 led John Hunter to undertake his classic research into the descent of the testis. Since then an enormous mass of literature has

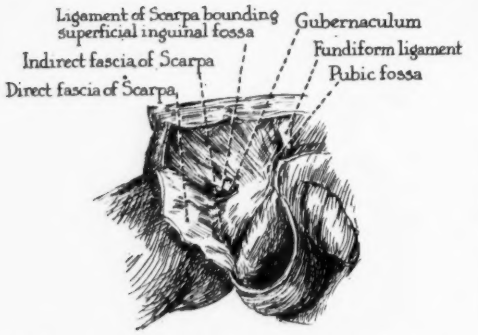

Fig. 27a. Dissections in a 5 months' fetus. The gubernaculum on right side is entangled in the superficial inguinal fossa. Note the rare pubic fossa.

grown up around this subject, and a great many ingenious theories have been mooted in explanation of it or its aberrations. One writer on the subject remarks that it is, indeed, a barren year which does not see the addition of at least one theoretical explanation of these phenomena.

It will be remembered that it was Hunter himself who gave the name of gubernaculum to the structure he invested with the function of causing the testicular descent. At the same time he suggested that the cremaster would be better called "the musculus testis." It seems strange that so wise a suggestion has never been carried into effect.

The gubernaculum theory has been amplified and occasionally altered somewhat but still remains vastly the most popular one in explanation of the migration of the testis. Curling was of opinion that the chief and only cause of descent is the gubernaculum.

Lockwood in his classical account, originated multiple gubernacular tails. By his careful anatomical researches in 1887 he was able to show several inferior insertions of portions of this structure. This has been very widely accepted and is very generally taught. Sonneland (31) questions this and finds no corroborative evidence embryological or anatomical for the existence of these tails. R. H. Hunter points out that in the newborn the testicle with its coverings and the tunica vaginalis can be lifted out of the scrotum without anything being torn, and argues that if the gubernaculum is not attached to the scrotal tissues, obviously it can have no action in pulling the testis down. Coley was not altogether convinced by Lockwood's article. Championiere emphatically opposed the gubernacular theory and remarked that such a physiological explanation was antiquated and childish, but ended up somewhat lamely by stating that nothing was known regarding the descent of the testis. Gowers, Godard, McAdam Eccles, Coley, Mixter, Eisendrath, Bevan, Sebileau, Budinger, and many others have made contributions to the subject.

Whether the testis has any intra-abdominal descent is questioned by Sonneland and others. These consider that actual descent only begins at the internal abdominal ring, stating that degeneration of ten or eleven body segments causes the testis to attain this position.

John Hunter pointed out that all the pelvic viscera are higher in the fetus than in the adult. According to Sonneland (31) the inguinal canal is formed by the abdominal musculature developing around the gubernaculum and a process of peritoneum which becomes the process vaginalis.

The existence of the gubernaculum is too firmly established to admit of any doubt. What is questionable is whether it does function as Hunter suggested, and it is just as doubtful whether Lockwood's tails effect ectopia as intimately as he supposed.

According to Sonneland (31) the testis reaches the external ring through the agency of three forces acting together. These are intra-abdominal pressure, intermuscular pressure, and active contraction of smooth muscle of the gubernaculum. Once beyond the external ring the only one of these three agencies which can be effective is the last.

According to R. H. Hunter it is the enlargement of the gut which is the main cause of the increase of intra-abdominal pressure. He argues that as the gubernaculum has no inferior attachment, the migration of the testis is entirely due to this pressure. Bland Sutton inclines to the opinion that migration is due to increase of intra-abdominal pressure in late fetal life.

John Hunter must have considered increase of pressure in the etiology of descent as he

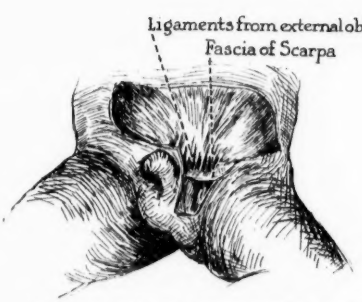

Fig. 27b. Fascia of Scarpa turned down showing ligaments holding third ring up to the external abdominal ring.

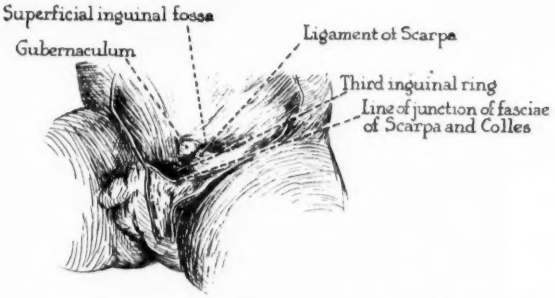

Fig. 27c. The gubernaculum on left side has emerged from the superficial inguinal fossa and is about to prolapse into the third inguinal ring immediately below it.

makes the important negative statement that as descent is complete before birth, respiration cannot affect it.

Fraser (18) states that normal descent depends on the plica vascularis and the gubernaculum. While discountenancing the former as a cause of imperfect descent, he remarks that beyond doubt the abnormality lies in the gubernaculum. Recent work tends to favor some hitherto unsuspected reason for descent. Experiments with animals indicate that the extra-abdominal position of the testes may be necessary to ensure proper temperature conditions.

This work being concerned with mal-descent rather than with normal migration, the physiological side of the question will not be further discussed.

Imperfect descent of the testis is a general term which was first used by McAdam Eccles to include any departure from the normal descent of the testis. According to Eccles (13), imperfect descent includes: (1) arrest of the testis at some situation in the normal route of its migration—(a) in the abdomen, (b) in the inguinal canal, (c) just below the external ring, (d) in the upper part of the scrotum (non-descent, partial descent, retention); (2) having emerged at the external ring the testis may deviate from the line of its normal route and go to (a) the perineum, (b) Scarpa's triangle, (c) the root of the penis, (d) between Scarpa's fascia and external oblique (maldescent, abnormal descent, ectopia).

Numerous explanations have been put forward to explain these abnormalities. It is not within the province of this paper to discuss imperfect descent proximal to the external inguinal ring. Distal to that the testis may be (a) in the scrotum, (b) partially undescended, (c) ectopic.

Some abnormality of the gubernaculum is most generally held responsible for errors affecting migration from the external ring to the scrotal bed. Arrest of the testis between these two points is partial or incomplete descent. This has been ascribed to fracture or loss of function of the gubernaculum, under development of the scrotum, adhesions from the tunica to the surroundings (Budinger) and many other causes. Eisendrath ascribes it to faulty development of the muscles of the inguinal canal. Sonneland (32) speaks of atresia of the scrotal neck. Eccles mentions persistence of the plica vascularis, shortness of the spermatic vessels (much the same thing), shortness of the vas, faulty action of the cremaster, and he ventures the suggestion that the pressure of a truss may prevent full descent. Godard favored the view that imperfect descent was due to heredity and was supported by Uffreduzzi.

So in this way instances may be multiplied; the multiplicity of suggested explanations is the best proof of the insufficiency of any.

Coming now to the question of ectopia testis, opinions are quite divergent. Eccles, whose authority is great, states that there are probably only two conditions which may cause this: (1) abnormal gubernacular action; (2) which pushes it into an ectopic position. An advancing hernia behind the testis.

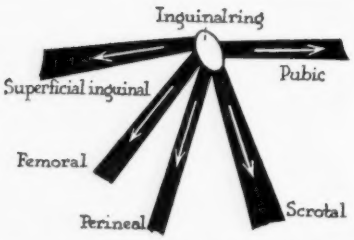

Fig. 28. Diagram from Eisendrath (modified) showing gubernacular tails of Lockwood.

Sonneland (31) states that the attachment of the ectopic testis, which is usually taken for the gubernaculum, is in reality a secondary attachment of the fractured gubernaculum, and advances what he calls an "accident gravity" theory. Briefly this implies a functionless gubernaculum, following the escape of the testis at the external ring, a long cord, the constancy of the fascial planes of the lower abdomen and perineum, and the operation of physical laws which govern a moving body. Some authors state that the site of ectopia is often determined by a fascial pocket, but beyond the bare statement, adduce no evidence in support of it.

The testis is said to roll in a fascial plane until it comes to a pocket which stops it. According to Burdick and Coley ectopia is often due to the testis passing posterior to Scarpa's fascia, these authors affirming that the normal path to the scrotum is between Camper and Scarpa. According to others the gubernaculum is normally attracted by the lymphatic tissue of the groin, and they assume that a congenital absence or abnormality of distribution of this lymphatic tissue is the original cause of the ectopia (quoted by Fraser, 19). It seems a strained explanation, as lymphatic tissue is more plentiful in the lumbar region where the testis develops than in the groin.

Because of the important function attributed to the gubernacular tails of Lockwood, it may be well to consider the present position of knowledge in regard to them.

Lockwood described the lower end of the gubernaculum as dividing into six processes. One of these passes to the normal terminus of the testis in the scrotum; a second goes to the perineum, a third to the pubis, a fourth to the root of the penis, a fifth to the external oblique aponeurosis near the anterior superior iliac spine, and the sixth to Scarpa's triangle. He assumed the scrotal fasciculus to be the best developed; it would, therefore, overcome the other processes and thus the testis would reach its normal scrotal situation. Should it happen that one of the other processes was the largest and strongest, the testis would be pulled in that direction and become ectopic. In support of this, a well developed gubernaculum is often described in connection with the ectopic testis, and Coley and others have figured this. It has already been noted that some surgeons have thought that this represents a secondary attachment of a gubernaculum which has become fractured. Though one gubernaculum is often referred to, multiple processes are neither described nor figured at operating. If this structure has no integumentary insertion, as R. H. Hunter claims, it is quite justifiable to assume the ectopia to be due to some other factor, in which case the gubernaculum would follow the testis into its aberrant site. Opinions on the matter are, therefore, divided. The kangaroo has testes which are normally pubopenile in situation, the pig has perineal testes. Those who favor Lockwood's theory say that this is due to the penile tail in marsupials and the perineal tail in swine being the strongest. Figure 28, modified from Eisendrath, is a diagrammatic representation of these tails in the human being. The writer's own researches have failed to demonstrate any subdivision of the gubernaculum. When some writers deny the existence of any evidence, embryological or anatomical (Sonneland) for the existence of these tails, and others peak of the evidence as being unconvincing (Coley), and others again deride the whole gubernacular theory as being childish and archaic (Championiere), it must be concluded that Lockwood's view is unproved.

Many of the opinions given in explanation of imperfect descent after the testis has left the external ring, are difficult or impossible to disprove. Were this not so the suggestions in question could have been ruled out. Lately John Hunter's original view has been revived,

namely, that imperfect descent is dependent on imperfect development of the organ. It is obviously impossible to disprove this, the more so as there is in all probability much truth in it. It is stated by many that whereas the retained or partially descended testis is deficient in development of the elements subserving its external secretion, the ectopic testis is usually fully developed. This is in favor of Hunter's view. Eisendrath's opinion that the primary fault lies in the development of the posterior wall of the inguinal canal is equally difficult to dispose of. At operations for partial descent the commonest reason why the testis cannot be replaced in the scrotum is the lack of development resulting in the shortening of the mesoblastic elements of the cord. There would seem to be come ground for the idea that this incomplete descent is due to abnormal persistence of the plica vascularis. On the other hand it might be argued that this was secondary and not primary. The same remark applies to the theory that adhesions are the cause of the trouble. Atresia of the scrotal neck has been observed, and this would be an absolute bar to further descent.

It is uncommon, so it cannot account for all cases. It may exist more commonly than is supposed for the reason that it is probably not looked for. Occasionally imperfect descent is associated with an absence of development of the homolateral half of the scrotum. This is much the same as atresia of the scrotal neck in regard to the obstruction to descent. Sonneland (32) makes allusion to fascial pockets of the cause of ectopia, but produces no evidence in support of this.

As to the anatomical explanation of imperfect descent of the testis after it has left the external ring, although it must be conceded in the present imperfect state of knowledge that such factors as congenital shortness of the mesoblastic elements of the cord, shortness of the vas, or adhesions may conceivably interfere with normal and complete descent, the author is of opinion, because of the results forthcoming in this investigation, that incomplete descent affecting the testis in its extra-abdominal course, and ectopia, are explainable on purely anatomical grounds. When structural conditions occur uniformly or very

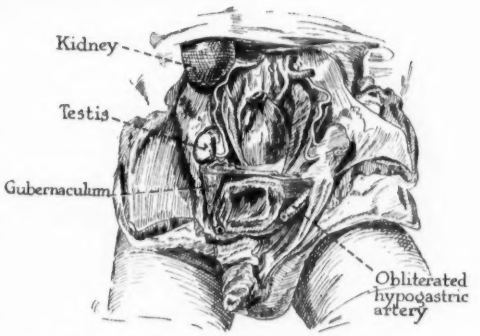

Fig. 29. Hunter's original drawing showing the gubernaculum in a case of abdominal testis in a 7 months' fetus.

commonly which offer an explanation for these abnormalities, it is only rational to accept the natural explanation rather than some theoretical assumption which does not admit of proof. Therefore, the writer ventures to bring forward the following explanation to account for incomplete descent below the external ring and for ectopic testis:

Imperfect descent is due to one or more of the following factors: (1) congenital anomalies or absence of the third inguinal ring, (2) congenital fascial pockets, (3) congenital fascial ridges. To render this statement lucid it has been thought wise to deal somewhat fully with the subject of ectopia testis.

Ectopia testis may be defined as a congenital or traumatic anatomical anomaly which is characterized by the position of a testis which lies not only without the scrotum, but outside of the normal path of its descent (Sonneland, 31).

Frequency. Among 59,235 cases of inguinal hernia in males at the Hospital for Ruptured and Crippled, from 1890 to 1907 there were 737 cases of imperfectly descended testis. The American War Department, in the examination of Army recruits, found 8,538 cases of monorchism or synorchism. This gave a frequency rate of 3.1 per 1000 males examined. It was noted that the distribution in certain big areas was unequal, which led to the suggestion that some racial peculiarity might be causative. Rennes and Marshall reported 17 cases of ectopia in 14,400 recruits examined for the Army (8). Da Costa (12) states that

in one person out of one hundred there is either undescended or ectopic testis.

Wrisberg says that 30 per cent of newborn male children have undescended testes. In most of these, descent is completed in the first few weeks after birth.

There are four varieties of ectopia testis: (1) superficial, inguinal or interstitial, (2) pubopenile, (3) perineal, and (4) crural or femoral.

These are the usual types. Banks reported a case of transverse ectopia of the testis. The condition is extremely rare and of an entirely different nature from the variety under discussion. The right testis had made its way through the left inguinal canal, having crossed the space of Retzius. Cases occur with extreme rarity if a crossing of the testes has occurred. Dichotomy of the testis is known to have occurred. In all these cases, entirely different factors come into play which do not affect ectopia in the ordinary sense.

The superficial inguinal testis was described as being extremely rare. Coley who has operated on a big series of cases of ectopia states that it is the commonest type. It occurred 73 times in a series of 537 cases reported by Burdick and Coley.

The testis lies lateral to the external ring, somewhere between this opening and the anterior superior iliac spine. Frequently it is just above and external to this ring. Like other forms of ectopia, it is almost invariably associated with a hernia behind it. The common belief is that it is pulled here by abnormal development of a gubernacular strand.

When the gubernaculum has emerged at the external ring it finds the third ring immediately below it. This ring is held open and toward the external ring by ligamentous fibers of the external oblique. It is the easiest route for the gubernaculum to take and the line of least resistance.

In the event of the third ring being closed, the force exerted on the testis, which is still in the canal, is transmitted to the gubernaculum which may be deflected in some other direction. There are four possibilities:

Should it go medially it will come in contact with the fundiform ligament. If the pubic fossa exists the gubernaculum and testis may be ensnared in the fossa.

If no fossa exists, it may continue to pass up and out and may come to lie just above the external ring. If, however, the gubernaculum is deflected out from the site where the third ring ought to be it will pass up in the gutter between the direct and reflected attachments of Scarpa. Along this gutter it may reach the anterior superior spine or fall short of this point. It has been shown that Scarpa in its outer half is often attached to the inguinal ligament and the spine. The attachments of Scarpa, therefore, direct the line of movement of the testis travelling in this way.

The fourth possibility is that the emerging gubernaculum finding its way to the scrotum barred, may remain in contact with the site where the third ring ought to be, most probably by contracting adhesions. In this case the testis has not been deflected from its normal path and becomes a case of imcomplete descent. It is here repeated to emphasize an important point that the third ring and the testicular scrotal bag are normally well formed before the gubernaculum reaches these areas.

These have been the consistent findings in this research. The gubernaculum, therefore, has no tunnelling to do in this region but finds its way prepared. If the gubernaculum possessed the excavating property so generally attributed to it, there is no reason why it should not bore its way through any obstruction below the external ring. It fails to do this and becomes partially descended or ectopic.

An obstructed third ring is one possible cause of interstitial ectopia. A second possibility exists. Figures 27a and c show the gubernaculum in different relations to the superficial inguinal fossæ on the two sides of a fetus. On the left side, the apex of the structure has emerged from the fossa and has surmounted the ligament of Scarpa which forms the anterior boundary of the fossa, and the posterolateral boundary of the third ring. On the right side the gubernaculum has not advanced so far, and its apex lies in the fossa. It has been shown that in a large percentage

of cases a well defined fossa lies just below the external ring, which fossa is formed by a prominent ridge—the ligament of Scarpa. The advancing gubernacular apex falls into this fossa. No doubt it usually surmounts the ridge. However, should it fail to do so, it will pass in the line of least resistance, which is toward the lateral open side of the fossa and so gain the gutter between the two attachments of Scarpa, and in this way lie on the external oblique aponeurosis, somewhere in the situation occupied by the superficial inguinal testis; once the testis has reached this fossa, the ilio-inguinal nerve is an additional bar to its return to its normal path.

The pubopenile type is rare. A case was reported by Sir Berkeley Moynihan, who describes it as one of the rarest forms of ectopia. The left testis lay on the dorsum of the penis 1½ inches below the pubis. It is significant that the left half of the scrotum was imperfectly developed. Cairns Forsythe records and notes a second case, also from Leeds, which was operated on by Mr. Edward Ward in 1902. The testis was tuberculous. The condition of the scrotum is not referred to. Other cases of ectopia pubo-penilis are on record. The testis rests in front of the pubis at the root of the penis, or on the dorsum anterior to the pubis.

One of the gubernacular tails is described as going to the pubis. This is held the responsible agent. It is, however, hard to see how, with its pubic attachment, it could bring a pubic testis to a position 1½ inches anterior to the bone. Anatomically the explanation is simple.

The third ring being closed, and the gubernaculum direct medially, it slides up alongside the fundiform ligament unless it meets the rare pubic fossa (Fig. 27a). In the latter case, it remains in the fossa where the testis follows. It may stay here to form an ectopic testis in contact with the pubis. The testis then rests on the dorsum of the penile root, which is the inferior boundary of the fossa. Now it has been shown in the foregoing that the layer of the fascia of Colles ensheathing the penis, continues proximally with the fundiform ligament at a right angle (Fig. 14).

The testis, therefore, in the pubic fossa may slip down and pass under this fascial junction, and the only bar to its progress along the penis is the length of the cord.

Anatomically there is no reason why the testis should not sag to the lateral aspect of the penis or even to its ventral surface, where it would be barred by the median raphe. Similarly with a sufficiently long cord it might advance to the reflection of the inner layer of preputial skin at the base of the glans. The writer would like to point out that a scrutiny of the delicately pointed gubernaculum on emergence from the abdominal wall strongly supports the assumption that this "feeler" would be easily deflected.

John Hunter described two cases of the perineal type in 1786. Curling gave the first detailed account of the condition in 1841 and collected 9 cases. He was the first to operate. The patient was 4 weeks old and succumbed. In 1879 Annandale performed the first successful operative cure.

Godard noticed 3 cases of perineal ectopia in 53 cases of imperfect descent. He mentions a case in which both father and son possessed perineal testis.

Klein reviewed the subject of ectopia. Among the 17 cases of ectopia in 14,400 recruits reported by Rennes and Marshall, not one was perineal. There were only 5 cases of perineal ectopia in 936 cases of imperfect descent associated with hernia, reported by Eccles. Coley had 9 cases of perineal ectopia among 126 cases of hernia associated with imperfect descent.

This variety of ectopia occurred fifteen times in 737 cases of imperfectly descended testicle observed at the Hospital for the Ruptured and Crippled from 1890 to 1907. The vast majority are unilateral. Hutchinson reported one case of bilateral perineal testis and Ammon reported another. Sonneland (32) states that of 92 cases of perineal testis many were traumatic rather than congenital in origin. This statement is rather surprising. Godard (21) reported the case of a man age 56 in whom an interstitial variety of ectopia became perineal as a result of a bandage having been worn for a long period. This case will be referred to again.

The gubernaculum is said to send a strand into the perineum, which is held to be

responsible for the testis occasionally reaching this situation. In these cases there is a lump in front of the anus to one side of the middle line. It has a restricted range of movements and rests in the superficial perineal pouch. The testis is usually of normal size and development.

It has been shown in the foregoing that in the perineal region there exists on each side two ridges of fascia which separate three pouches. The perineoscrotal reduplication of Colles' fascia separates the scrotal from the superficial perineal pouch. This reduplication forms a smooth ridge. The fascia of Colles here doubles back on itself at an acute angle in the adult dependent scrotum and at a right angle in the fetal scrotum (Fig. 12). The testis or gubernaculum having traversed the third ring, passes down the scrotal neck and arrives at this ridge. At the sixth month there is a well marked scrotal pouch in the vast majority of cases. Should the fascial reduplication narrow or occlude the orifice, the testis cannot enter and may pass posterior to it into the perineum. It is not atresia of the scrotal neck as supposed by Sonneland which causes this type of ectopia, but atresia or lack of development of the actual testicular pouch. Atresia of the scrotal neck causes, as seen above, incomplete descent or interstitial or pubopenile ectopia.

In those few cases in which perineal ectopia is due to trauma applied to a partially descended or interstitial testis, the same mechanism occurs. The testis is forced down, and as the empty scrotum will be contracted, it may easily pass behind the ridge into the perineum. Where the corresponding half of the scrotum is entirely undeveloped, the descending testis must necessarily be ectopic, whether this be perineal or crural. In these cases of ectopia the cord is long and there is no difficulty in retaining the testis in the scrotum by operation.

It is agreed that crural or femoral ectopia is one of the rarest forms. There are two views in regard to its development. The testis is somewhere in the neighborhood of the saphenous opening at the root of the thigh. According to Wakely and others the condition is due to a very long mesorchium.

As the testis approaches the external ring, the long mesorchium cannot exercise its customary control, so that instead of the testis being held close to the internal ring, it slips down to and prolapses through the femoral canal. It is in other words a hernia of the testis through this canal. This mode of descent is doubted by many writers. Eccles states that it is extremely doubtful if the testis has ever reached the upper part of the thigh by a spontaneous passage through the femoral canal. He further states that the classical instances of this are not very convincing. That this mechanism extremely rarely may be operative is shown by the case of Fauntleroy. This case is introduced as being the only one in surgical literature in which the testis has descended through the femoral canal and into the scrotum. So that it was not a case of ectopia finally, though it must have been so at one stage of its descent. A simpler view is that the crural testis is deflected once it gets beyond the external ring. Eccles says that the gubernacular fibers going to Scarpa's triangle are fairly constant, but are only found at a comparatively early stage of intra-uterine life, disappearing usually 2 months before birth. He goes on to say that it is not clear that the gubernaculum can cause crural ectopia, inasmuch as the testis may go to Scarpa's triangle as late as commencing adult life. In this variety of displacement the cord can usually be traced through the external ring, by palpation.

It has been shown earlier in this paper that the line of the direct attachment of Scarpa's fascia to the fascia lata is variable. It may, as shown in Figure 4, cross the saphenous opening at a higher or lower level, depending usually on the degree of development of Scarpa's ligament. In those cases in which the ligament is absent, Scarpa's fascia crosses the adductors and the opening rather more obliquely on its way to the ischiopubic ramus than it does in those instances in which the ligament of Scarpa holds the fascial attachment forward toward the pubic tubercle. It has also been seen that where no ligament of Scarpa exists, the outer boundary of the third ring is the gutter between the direct and reflected attachment of Scarpa, and that this gutter passes

across the adductors to the fusion of Scarpa and Colles at the pubic ramus just below the situation where the falciform process of Colles is given off. The crural pouch is situated at the site of this fusion. It is of great interest to observe that the crural pouch is situated behind or internal to the inguinoscrotal fold. The most cursory examination of any male subject will show that this fold does not directly overlie and correspond to the ischiopubic ramus, which intervenes between perineum and thigh. On the contrary, and against the general belief, this fold crosses the root of the thigh. Now as the femoral pouch is behind or medial to this fold, a testis in the pouch bears the same relation to the fold. Such a testis may bulge medial to it, or lateral to it, or push the fold forward. Thus it may easily be mistaken for a perineal testis when in reality it is crural. Only a thin fascia, namely that of Colles at its attachment to the ramus, separates it from the perineum. Operative methods through the usual inguinal incision, would fail to distinguish the situation of the testis. It may be stated that unless the inner border of the organ impinges on the mid line, it is probably a crural and not a perineal testis. It would seem, therefore, that this abnormality may arise in one or two or possibly three ways.

1. The testis having passed the third ring lies in the neck of the scrotum suspended above three pouches, the scrotal, the perineal and the crural. Just as the perineoscrotal reduplication separates scrotal and perineal pouches, so the falciform process of Colles intervenes between the perineal and crural fossæ. Only the razor edge of this process separates the descending gubernaculum from the crural pouch. Now this edge is level with the bone above and rises gently to a ridge as it is followed down. The gubernacular apex is easily deflected, should it pass lateral to the edge, the testis is crural.

2. When the third ring is of a wide funnel variety as happens when the ligament of Scarpa is undeveloped, the testis may be hung up somewhere along the gutter bounding the ring laterally. Atresia of the lower part of the scrotal neck or a short cord may be at fault. In this way the testis may come to lie over the saphenous opening or anywhere along the gutter, right down to the crural pouch. It is conceivable, therefore, that a testis lying in the upper part of this gutter, whether it be superficial, inguinal, or upper crural in type, may through trauma be pushed down to enter one of the three perineal pouches depending on the direction it is forced to take by the two fascial ridges. It will be remembered in Godard's case that an interstitial ectopia became perineal through the wearing of a bandage. It is more than likely that even though the testis occupied the crural pouch it would be called perineal because of its relation to the inguinoscrotal fold.

3. The writer has wondered whether a testis lying in a deep superficial inguinal fossa may not be called a crural testis, as this fossa is just above and medial to the uppermost part of the saphenous opening.

CONCLUSIONS

It is, therefore, apparent that once the migrating testis emerges at the external inguinal ring, it enters upon the most perilous and hazardous stage of its journey. When the obstacles to the successful performance of this transit are reviewed, the marvel is not that the organ becomes ectopic at times, but that it should so often succeed in reaching its normal destination through such a maze of devious paths.

As often as not the first barrier encountered by the scouting gubernaculum is the hog-back formed by Scarpa's ligament. Here it lies in a deep valley which may cause it to travel out at right angles to its intended path. Negotiating this depression and ridge successfully, it arrives at the entrance to the scrotal tunnel, i.e., the third inguinal ring. Should this be absent or underdeveloped (and this may be the case with an apparently normal scrotal development as viewed from without) the gubernaculum, which is incapable of excavating, may adhere to the site where the orifice should be and remain permanently partially descended. On the other hand it may trend medially and then will either travel up or out along the fundiform ligament to a high superficial inguinal resting place. Should it, however, encounter a cave at the side of the fundiform ligament, it may adhere there, or

slip down by its own weight; nothing obstructing its progress along the penis but the length of its own central attachments.

If the third ring transmitting to the scrotum is open it has not yet passed the dangers. It may come to rest somewhere in the gutter formed by Scarpa's fascia, or it may be pushed off the road by either of two additional ridges, namely, the falciform process of Colles, or the perineoscrotal reduplication. Failure to negotiate one of these obstructions will permanently prevent the testis arriving at its scrotal bed.

The author wishes to suggest that these anatomical ridges, fossæ, and orifices, some of which are present in all subjects, others of which exist in a large proportion of cases, are the most natural and likely explanation of cases of partial descent or of ectopia affecting the testis during the extra-abdominal portion of its intricate transition from abdomen to scrotum.

SUMMARY

1. The superficial fasciæ of the groin and perineal regions have been investigated in great detail in the male subject from fetal life to old age.

2. Certain hitherto unsuspected anatomical features of great practical importance have been disclosed by the research, particularly in regard to the fasciæ of Scarpa and of Colles.

3. An undescribed layer of fascia in the perineum has been named the deep fascia of the perineum.

4. The complicated method whereby the scrotum is slung is analyzed in detail and serves to throw some light on the cause of the inequality in rate of growth of hernia.

5. Certain fascial pockets exist in the perineum and groin in a large percentage of cases. These pockets are proportionately better marked in the fetus than in the adult.

6. A third orifice is described in the inguinal region which has been named the *third inguinal ring*. This presents the form of a ring in 50 per cent of cases, and the shape of a funnel in the remaining cases. It is of vast importance in connection with imperfect descent of the testis. It is easily felt clinically.

7. No evidence has been forthcoming in this research which lends the least support to (a) the supposed "excavating" function of the gubernaculum; (b) the "traction" function of this band; and (c) the existence of the gubernacular tails of Lockwood.

8. It is shown that the spermatic cord lies as a rule ½ inch lateral to the pubic tubercle and not medial to it.

9. Extravasation of urine is shown to extend largely as an infiltration of the superficial fasciæ rather than as an extravasation deep to them.

10. Femoral hernia may emerge above or below the attachment of Scarpa's fascia in the groin. The size of the hernia and the direction it takes may be dependent on its relationship to this fascia.

11. The literature of imperfect extra-abdominal testicular descent is reviewed.

12. A new explanation of this imperfection is put forward. It is based on anatomical findings and may fittingly be called the "anatomical explanation." Partial descent and ectopia are due to one or more of the following factors: (a) congenital anomalies or absence of the third ring, (b) congenital fascial pockets, and (c) congenital fascia ridges. It is impossible to exclude as further possible causes such factors as shortness of the mesoblastic elements of the cord, or adhesions. It is, however, pointed out that such occurrences may be secondary and not primary.

13. The anatomical explanation of the various types of ectopia is entered into in considerable detail, and the genesis is explained.

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CAUSES OF MORBIDITY AND MORTALITY OF OPERATION FOR GALL-STONE DISEASE[1]

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THE early stage of gall-bladder disease is regarded as a general metabolic disorder in which the liver plays a prominent rôle. This early stage is most often seen in young women coming to operation for symptoms of gall-stone disease after a more or less recent pregnancy. The gall bladder of such a patient is usually normal in appearance, and its bile is sterile. Bile stasis within the gall bladder is another early stage of the disease. Either of the two are the forerunners of infection which, as I have constantly maintained, is no doubt due to the irritation caused by the presence of stone and the obstruction to the free flow of bile. The bacteria brought to the gall bladder from the liver or from the blood stream, fail to be carried off by the bile which remains more or less stagnant. Here, then, we have the interplay of liver and gall-bladder function and pathology. The effect of prolonged disease of the biliary system is furthermore seen in the phenomenon of dilatation of the right heart and myocardial weakness. The fact that there is an excess of bile in the blood without an accompanying cholesterol increase, indicates involvement of the liver cells. This is furthermore shown clinically by signs of portal engorgement which eventually must interfere with the general circulation, leading to dilatation of the right heart with secondary passive congestion. If the process remains unchecked, repeated congestion causes the liver cells to lose their activity and cirrhosis dominates the picture. These facts, baldly stated as they are, furnish food for thought in connection with the morbidity and mortality of operation for gall-stone disease.

The question whether the gall bladder or the liver is primarily responsible for the consequences of gall-stone disease is an important one. Some investigators believe that liver involvement is, as a rule, the first step. However, this is not universally true if we are to believe the findings of workers such as A. L. Wilkie who in his experimental work on rabbits clearly demonstrated cholecystitis as an entity capable of occurring independently of liver involvement. By separating the gall bladder from its liver bed and interposing a small portion of the great omentum, shutting off all lymph and blood vessel connection with the liver, and injecting streptococci intravenously, Wilkie produced cholecystitis when the cystic duct was, and when it was not, ligated. On the other hand, when rabbits, without any previous operation having been done were injected, cholecystitis together with involvement of the surrounding liver substance resulted. This work, with that of Rosenow, Reimann, Graham, and others, proves that infection of the biliary tract takes place through the gall bladder and through the liver. Basing my conviction on the evidence of reports from the Lankenau Research Laboratory on the bacteriological and pathological study of numerous specimens, I am convinced that this is exactly what we surgeons find in autopsies *in vivo* in liver and biliary tract disease, to which I refer in this discussion.

Furthermore, it is our experience that removal of the gall bladder gives its best results where the liver is found practically, if not entirely, normal to inspection and palpation, while where the liver is more or less diseased, the ultimate results are not so good, and a certain percentage of patients fail to be relieved by operation. Removal of the chronic, interstitially diseased gall bladder, the most frequent type of the disease, in the presence of a diseased liver merely breaks the chain of a vicious circle.

A matter of primary interest is the indication for operation. The difference of opinion between the internist and the surgeon in this regard, I believe, constitutes one of the main factors in the subject under discussion. It would have been interesting and valuable, if time had permitted, to have collected the opinions of some of our prominent internists as to how many of their patients they refer to

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the surgeon and at what state of the disease they do so. Leaving acute cholecystitis out of consideration, I have no doubt that the consensus of opinion would be "not until conservative treatment had proved ineffectual," without mentioning the time element. Some might qualify their statement by saying, "not until the discomfort becomes unbearable." The question, however, should be considered from the social economic, as well as from the pathological standpoint.

On the whole there are few, especially among the large middle class, who can afford the more or less disability and expense that prolonged medical treatment entails. I believe that I am safe in saying that there is no difference of opinion as to the necessity of treatment including a careful regimen, in these cases. I fully realize, also, the difficulty of controlling the patient's mode of living, especially among the less intelligent classes; this, no doubt, accounts for a large group of cases that fail to get well by any mode of treatment. On the other hand, the cures obtained by conservative treatment are more often than not temporary, as proved by a recrudescence of the trouble. Moreover, spontaneous absorption of gall stones is a pious thought, fathered by the wish, and should it take place, some fragmentary concretions would inevitably remain to form the nucleus of later stone formation, so that in all likelihood the patient's later condition would be worse than his earlier one.

In the earliest stage of gall-stone disease, if primary in the gall bladder—the stage of metabolic disturbance—the disease does not extend beyond the cystic duct. In other words, it attacks only the mucosa of the gall bladder and the cystic duct remains unobstructed. In these cases medical treatment, especially nonsurgical biliary drainage, should be promising when associated with the proper regimen, including rest and diet directed toward altering the blood chemistry. Unfortunately, however, the disease usually resides in the walls of the gall bladder and it is only by removing the gall bladder itself that the process can be checked and the ravages of continued infection prevented, such as cholangitis, hepatitis, hepatic abscess, pancreatitis, cardiac and renal derangement, etc. This is my answer to the question as to the stage of the disease when the patient should be referred to the surgeon. Two, or at the utmost, three attacks of gall-stone colic should settle this point.

Of course, I know that many will make the mental reservation that surgery does not always prove successful. I quite agree with you. But why does it not, in spite of good surgical technique? Here is the answer.

From the follow-up observations in the Lankenau Clinic, we find that of the patients who fail to be entirely relieved within 2 years, 59.5 per cent give a history of 2 to 20 years of digestive trouble and attacks of gall-stone colic; while 40.5 per cent give a history of 1 to 2 years. Let us review a few of the pathological findings at operation in some of the long-standing cases.

(2633/21) Pre-operative history 12 years; common duct obstruction by stone; peripancreatic lymphangitis.

(3478/20) Pre-operative history 12 years, emergency operation in an acute attack. A spontaneous duodenal fistula had formed. Adhesions found involving stomach, duodenum, liver, and colon. Appendix acutely inflamed.

(916/21) Pre-operative history, 5 years. Dense adhesions involving the gall bladder and the liver. Enlarged nodes along the common duct. Head of pancreas enlarged and hard. This patient was well for 13 months after operation. When seen again 1 year later (24 months after operation), she complained of pain and swelling over the site of the liver and was slightly jaundiced.

(1118/21) Pre-operative history, 6 years. Neck of gall bladder adherent to common duct. Gall bladder opaque and thickened. Hepatic flexure of colon adherent to liver.

(2473/21) Pre-operative history, 18 years. Cystic duct partially occluded by stricture, many faceted stones present.

These cases were selected at random. While on the whole they are typical, I am sure that I could have found numerous other ones with more extensive affections to worry the surgeon at the operating table, to say nothing of the worries of the patient before and after operation. The only consolation the latter has is that without operation he would have been either much more miserable or else would have been transported to the bourne whence none return.

It is scarcely reasonable to expect a cure where there has been such extensive disease.

This is all the more to be regretted since it is, to a large extent, avoidable.

From the surgical point of view the most regrettable cause of postoperative morbidity is failure to remove the diseased gall bladder or remove the gall bladder, drain the common duct, and determine the patency of the papilla of Vater; if it is not perfectly patulous it should be dilated. Contracture of the papilla of Vater by inflammatory œdema, stricture, calculus obstruction, tumor, etc., may result not only in back pressure of the bile but of the pancreatic secretion as well. Retention of pancreatic secretion in turn may cause focal necrosis of the pancreas such as occurs in a small percentage of cases of so-called catarrhal jaundice that do not clear up in a comparatively short time. Therefore, change in the papilla may be one of the causes of catarrhal jaundice and of histological changes in the pancreas. Of course in acute cases, the conservative operation is rational, but in the absence of such or other contra-indications, radical surgery should be the chosen procedure. There may be some patients, few and far between, however, who will not consent to having the gall bladders taken out. They have a perfect right to refuse and also are welcome to keep on being threatened with recurrent attacks of gall-stone colic and all its consequences. On the other hand, there are some surgeons who still adhere to the conservative method of the early days of gall-bladder surgery when cholecystectomy was considered a difficult and formidable operation. They have the questionable satisfaction of contributing liberally to recurrent cases. Whether or not stones are actual recurrences or new stone formations or a stone has been overlooked, is not so important as that they occur most frequently after a cholecystostomy.

Recurrence of gall stones and persistence of symptoms after cholecystectomy is another matter. The latter, especially, can be traced directly to delayed operation. For example, while stones may be, but rarely are, secondary to cholangitis, in most instances the reverse is true, in that prolonged calculous infection leads to a cholangitis, which as we all know, is stubborn, troublesome, and dangerous, requiring prolonged surgical drainage and a strict dietary and hygienic regimen. I have drained the common duct as many as three different times in one patient. Each time I removed many minute stones mixed in with muddy, dirty looking bile. At the last two operations after clearing the hepatic duct and its primary branches with a scoop, I irrigated the duct. Since the last operation, 5 years ago, the patient has remained perfectly well.

It must be remembered, also, that gall-stone disease oftentimes affects surrounding organs besides the liver, causing a chronic pylorospasm, peptic ulcer, pancreatitis, as well as cardiorenal derangement. Indeed, gastroduodenal involvement is very frequently associated with gall-stone disease demanding still further surgery, mainly gastro-enterostomy. More serious, because less amenable to treatment, is pancreatitis, either as a primary surgical complication or as a postoperative phenomenon. If at the primary operation the peripancreatic glands and the head of the pancreas are found affected, persistence or recurrence of symptoms is to be expected, although a prolonged and careful postoperative regimen may prevent serious trouble.

The presence of such changes makes a complete cure doubtful. It also raises the question of radical versus conservative surgery, the answer to which will depend, to a great extent, on the degree of pathology. Marked hepatitis, and marked cholangitis as well as marked pancreatitis may be handled by making either a cholecystoduodenostomy or a cholecystogastrostomy after the stones, if present, have been removed from the gall bladder; however, common duct drainage with a T-tube is the better procedure. In passing, I would say that in neither of the anastomosis operations does the new stoma remain permanently patulous, except in the presence of complete occlusion of the common duct. Furthermore, the cholecystoduodenal anastomosis is a delicate operation and in the hands of the less experienced surgeon presents the danger of a subsequent duodenal fistula, so that the gastric anastomosis is the safer of the two procedures. On the other hand, as long as the gall bladder remains *in situ*, reformation of stones is likely to occur, even where the gall bladder has been anastomosed.

As a not infrequent cause of postoperative morbidity, chronic pylorospasm should always be looked for and corrected. It is our practice to remove the anterior half of the pyloric sphincter, and our results have been very satisfactory. While making the Rammstedt operation is better than not doing anything, removal of the anterior half of the sphincter offers better and more permanent results.

Postoperative adhesions, although not uncommon as a cause of morbidity, do not play the rôle so often attributed to them. This can be best exemplified when an operation is done to remove stones in the common duct in the presence of extensive adhesions. In these cases better results are obtained if it is possible to remove the stone without separating the adhesions. I believe recurrence of symptoms, so often attributed to adhesions, is more often due to chronic pylorospasm. However, the adhesions should be released but the pylorus should not be overlooked.

Fistulous communication between the gall bladder and usually the duodenum, and occasionally with the hepatic flexure of the colon, may be a remote cause of morbidity. In either instance, but particularly when the communication is with the colon, infection of the liver will ultimately occur causing a symptom complex almost impossible to recognize except by sight and touch.

The most frequent causes of postoperative morbidity and mortality are some form of chronic disease of the liver, the result of a latent infection not easily recognized as such and not subjected to operation at the most opportune time when looking and acting would accomplish more than watching and waiting to see what will happen. The chronic liver is seen as either a circumscribed or a diffused fibrosis, a cholangitis, or a solitary abscess.

Circumscribed fibrosis is more common in the right lobe and more marked near the site of the gall bladder. It is manifested by white streaks on the surface, increased consistency, rounding or thinning out of its anterior border, some enlargement of the lobe especially fore and aft, and in some instances, the presence of a circumscribed boggy œdematous condition. When the left lobe enters into the picture there is usually an accompanying enlargement and fibrosis of the spleen. Diffuse fibrosis, fortunately, is not so common a finding, but when seen comparatively early is readily recognized by the size and consistency and the thick, rounded anterior border of the liver. Occasionally a hydrohepatoptosis is seen and is usually associated with involvement of the common duct. I have known this to be so pronounced as to make the outlook seem most uncertain, but had the satisfaction of seeing it clear up after several weeks of drainage of the common duct.

A large and important aspect of our subject is common duct involvement, a complication practically always due to gall stones or their sequelæ. Stone in the common duct is rarely a primary affair. With few exceptions, biliary calculi originate in the gall bladder. When I operate for stone in the common duct I feel sorry operation was not made before the stone left the gall bladder. Involvement of the common duct, therefore, is the result of more or less prolonged gall-stone disease. Such involvement may also lead to stricture of the common or of the hepatic duct or of the papilla of Vater and to regurgitation of duodenal contents (after operation) upon the duct the result of loss of function of the muscle of Oddi, due to prolonged obstruction of the duct. Stones or any other of these complications add materially to the seriousness of biliary pathology both clinically and surgically and are potent factors in the morbidity and mortality of gall-bladder surgery. As far as calculous obstruction of the common duct is concerned, one simple reason for persistence of symptoms after operation is the fact that one can never be sure that all stones or traces of stone have been removed from the bile ducts at the first operation. While it is possible for stones to form in the ducts after a cholecystectomy or a choledochostomy or both, it is a safe guess that recurrent attacks of typical gall-stone colic after these operations are due to stone overlooked at the primary operation.

From a surgical point of view there is perhaps no region in which accidental trauma is so easily inflicted as the common duct. Surgery upon this duct requires a clear exposure, a sharp feather-edge dissection, and a bloodless field. Also the details of searching for

stone in the common duct are delicate to the extreme and the effects on the body of manipulations in this region, as pointed out by Crile, are comparable to the effects of manipulation on the spinal cord or the brain. Then, also, there is the effect on the liver function caused by draining the common duct, and the sudden decompression of bile in a jaundiced or recently jaundiced patient. The toxic effect of jaundice on the entire system needs no discussion. We all know that it means a tendency to bleed, as well as hepatic and renal insufficiency. Again, I am obliged to say that this complication is to a large degree avoidable by early attention to cholecystitis and its associated phenomena.

Not all cases of postoperative morbidity in biliary tract disease, however, are due to actual recurrences. Neurosis contributes largely to this class of cases. Although imaginary ills to the complainant hurt as much as real ones, they are neither so easily nor so successfully treated. There are, no doubt, many people who enjoy poor health. What to do with such I gladly leave to the neurologist, the psychiatrist and the psychoanalyst.

Now as to the surgical mortality of gallstone disease.

In the Lankenau Clinic, the most common cause of death is cardiovascular disease—acute dilatation, embolism, and coronary thrombosis. Whether or not acute dilatation is an entity is questioned by some of our able internists we know it occurs, but these opinions to the contrary notwithstanding. Most cardiac deaths occur in heavy, obese women in whom, doubtless, the deposit of fat about the heart acts as an additional factor in a heart that, in most instances, is already attacked by myocardial weakness. In these cases we derive very little satisfaction from digitalis; in our experience, small doses of morphine given at regular intervals are much more effective. Do what you can, and say what you please, these obese patients increase the weight of our responsibility.

Pneumonia stands very low in the list of causes of postoperative deaths. This is, at least, partly due to operating under intraspinal anæsthesia which enables the surgeon to work rapidly and with greater ease, which in turn, of course, means less risk to the patient; diathermy also is a great factor in reducing the incidence of postoperative pneumonia.

So-called liver shock, spoken of by many writers, we rarely if ever, see. We agree with Crile that shock is due to faulty pre-operative care and failure to use diathermy during the operation. Diathermy is our stand-by in all serious abdominal operations. As remarked by Miss Rapp, our chief anæsthetist for many years:

"Doctor, your diathermy patients are not sweaty and depressed as they were before we used this means of maintaining as well as increasing, the bodily temperature."

Maintaining the temperature of the liver and the bodily temperature in heavy abdominal operations is most important and can be best obtained by the application of diathermy not only during the operation but, in some instances, for some hours after operation. We have found it very advantageous, for example, in chronic cholangitis of some standing with profound jaundice, after a drainage operation to apply diathermy constantly for 2 to 3 hours daily. There is no other organ whose depressed function so affects the entire system as that of the liver. It is, therefore, essential to take advantage of such liver functional tests as are at our disposal, and to bring liver function as near to the normal as possible before operation, and to avoid depression during the operation by the use of intraspinal anæsthesia and the keeping of the entire field warm by the use of diathermy effectually and hot gauze pads within the abdomen. The systemic effects of hepatic disease or surgical trauma are sufficiently explained by the nerve supply of the liver. Lying as it does, within the center of the sympathetic system with its network of nerves and ganglia close to the cœliac plexus, this intricate plexus is necessarily affected by anything that affects this intra-abdominal area, including of course, the gall bladder whether by a disease process or operative trauma, or postoperative contact with drainage or adhesions. If, as Crile well says, the cœliac plexus is the abdominal brain, then the liver can be called the abdominal medulla.

In some cases of calculous obstruction of the common duct associated with marked jaundice as well as in certain cases of cholangitis and hepatitis, a cause of mortality is failure to make a preliminary cholecystostomy for the purpose of decompressing the liver. In addition to this preliminary drainage, diathermy to which I have referred, is a most valuable adjunct. Decompression by simple gall-bladder drainage is likewise applicable to bad risks such as certain cases of chronic pancreatitis and carcinoma. If improvement follows this procedure and the patient's condition warrants, further surgery may be done. An anastomosis operation may often be successful, although the easiest way out is not by any means always the best, yet it has its indications.

As I have said, the effects of obesity add materially to the surgical risk. As most gall-bladder patients are not emergency cases, some surgeons advise a rapid reduction of weight immediately before operation. This is a questionable procedure inasmuch as it also reduces the patient's power of resistance. If loss of weight is desirable, it should be done slowly by suitable diet and exercise, depending, of course, upon the general health of the patient and the severity of the gall-bladder symptoms. It is in the obese, stocky patient, also, that pulmonary embolism is most likely to occur, although there is no way whatever of foretelling or forestalling this hapless and usually hopeless catastrophy which we all dread and deplore. Coronary thrombosis, on the other hand, is a condition that may have manifested itself before operation. While this complication constitutes an unpleasant surgical risk, spinal anæsthesia has brought many of such patients within the operable class, but they require special pre-operative and post-operative care to prevent an attack. Sometimes, however, in spite of all precautions, a sudden seizure carries the patient off and surgery bears the blame, unjustly, of course. If in these cases, the gall-stone disease was of long standing the inference is plain.

Hæmorrhage, in our experience, rarely occurs except in the presence of severe jaundice and even then only seldom, owing to the advances made in pre-operative and post-operative care by the intravenous administration of calcium chloride, and blood transfusion in addition to X-ray of the spleen before operation to lessen the clotting time. This is one of the greatest steps forward in gall-stone surgery that has occurred in recent years. An occasional case of carcinoma that has been jaundiced for several weeks will succumb to bleeding after operation, do what you will. This only argues in favor of more prompt interference in jaundiced patients that do not yield to treatment in a week or 10 days. Oftentimes the reason for deferring operation is the uncertainty of the diagnosis. This, I believe, constitutes one of the strongest indications for opening the abdomen. Primary and consecutive bleeding should not occur if the operation is properly made and secondary hæmorrhage should be rare except in the severely infected cases, and these are not frequent.

Primary and consecutive bleeding are the result of not exposing and tying the cystic artery or its two branches under the guidance of the eye, the *sine qua non* of a successful operation. Another cause of bleeding is failure to close the gall-bladder bed completely by suture where it has not been possible to do a subserous cholecystectomy, although by careful dissection this can nearly always be done. In closing the gall-bladder bed all small bleeding vessels should be ligatured before the bed suture is introduced. Packing the gall-bladder bed to arrest either primary or secondary bleeding is obsolete, and is only very exceptionally indicated. Here, as elsewhere, knowledge of the anatomical relations of the parts exposed is absolutely essential in order to avoid mistakes. Where bleeding occurs soon after the primary operation, the only rational course, with few if any exceptions, is to open the wound and secure the bleeding point or points. Secondary bleeding, the result of an ulcerated process, is a different proposition. Here, thorough packing carried to the extreme depth of the wound is the correct procedure. Blood transfusion may be necessary but will not take the place of good surgery, nor is it to be given injudiciously. I have seen serious consequences from blood transfusion, such

as a blood clot carried along causing thrombosis, embolism, and death.

So-called bile peritonitis occasionally listed as a cause of death, I believe, in most instances, is not peritonitis at all but intraperitoneal leakage of bile. Whenever I have had the opportunity to operate in such conditions where a large amount of bile is drained, the smears were negative. A peritonitis with bile in the peritoneal cavity, may result from bacteria having passed through the intestinal walls. Early evacuation of the bile will solve the riddle.

In this connection, I would call attention to some recent work of Ravdin, Morrison, and Smythe at the Laboratory of Research Surgery of the University of Pennsylvania. They make a distinction between bile peritonitis and bilous ascites transudations or extravasations. In the former the patient presents a picture of a diffuse or diffusing peritonitis, while in the latter there may be a large accumulation of bile-stained fluid which is apparently innocuous. They have confirmed the work of other investigators, that sterile, as well as infected bile, may cause bile peritonitis. Of course it is possible that the bile, especially if enough of it is present, causes denudation of the serosal surfaces and thus permits of secondary infection.

In bilious ascitic accumulations, the toxic factor of the bile is either not present or only a very small amount is present. Ravdin and his co-workers believe that in these cases the fluid is a transudate from the portal system, as a result of portal stasis associated with obstruction of the common duct.

A unique case of bile ascites occurred in my experience some time ago. The patient, a hard working preacher, was sent to me with the diagnosis of abdominal carcinoma and ascites with jaundice. I concurred in the diagnosis, but when the abdomen was opened there was found a large amount of bile-stained ascitic fluid, a very much enlarged gall bladder and common duct with enlargement of the liver, which was normal in consistency, but a little darker than normal, due to back pressure of bile, fibrosis of the head of the pancreas, enlargement of the peripancreatic glands and, on opening the common duct, occlusion of the papilla of Vater. No evidence of stone or malignancy was present. Continuous drainage of the common duct for a number of weeks and dilatation of the papilla of Vater resulted in complete recovery, and the patient has remained well. In passing, I may say in my experience, such cases are rare.

Infection is a cause of mortality in a small percentage of cases, especially if the streptococcus and colon bacillus are the predominant organisms. I am glad to say we do not meet with this as often as formerly, partly due, I think, to the introduction of cholecystography. Cholecystographic study, in fact, is largely responsible for earlier recognition of gall-stone disease by the internist who usually sees the patient first. I am operating upon more early cases than before Graham's epoch-making discovery which, no doubt, has lessened the responsibility of the internist and of the surgeon as well. The surgeon, however, still has to make too many decompressions of the liver in jaundiced patients largely due to delay in advising surgery.

Much has been written upon the relationship between late gall-stone disease and the toxic heart. Granting the views expressed in these discussions to be correct, which I believe they are, the toxic heart then becomes a sequel of delay and fatality caused by such a diseased heart should not be shouldered upon the surgeon.

That hepatic insufficiency plays a rôle in the mortality following operation for gall-stone disease is evidenced by the reports of various surgeons on this important subject. We furthermore know that hepatic insufficiency is the forerunner of renal insufficiency. This explains why formerly many deaths from hepatic insufficiency were labeled as due to uræmia.

The question, naturally, is related to liver function, the study of which is still in its infancy although progress in the right direction is being made. It goes without saying that a safe and practical test for liver function, such as we have for renal function, would go a great way toward reducing the deaths from hepatic insufficiency, for the results of such tests would decide the question of operation. It is

true that the phenoltetrachlorphthalein test claims to meet the requirements of accuracy, simplicity, and safety, but its safety is questioned, inasmuch as a deleterious effect on the liver cells has been observed. On the other hand, such an eminent authority as Rowntree finds it a perfectly safe procedure. As I have said, the matter is not as yet definitely settled. Co-operation of the laboratory research workers with the surgeon will finally provide the answer, I feel sure.

On the whole, it may be said that there are still too many patients who come to surgery as a last resort. Improvement in morbidity and mortality of operation for gall-stone disease will go hand in hand with early diagnosis and early surgical treatment where reasonable medical measures have failed.

BENIGN TUMORS OF THE FEMALE BREAST

A Clinical and Pathological Study of 201 Cases Treated between 1875 and 1928 at the Clinic of The Free Hospital for Women, Brookline, Massachusetts

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THE object of this analysis is to determine the results of operation for benign breast tumors, the percentage and character of recurrences, the frequency of bilateral involvement, the incidence of malignancy and the type of benign change with which malignancy is most likely to be associated. Since difficulty in arriving at a definite diagnosis in some cases was experienced early in the work, emphasis has been placed on the classification. This difficulty is by no means new, since, from the first attempt at systematic classification in 1905 by J. Collins Warren, there has grown up a varied and confusing terminology.

Before the middle of the nineteenth century all tumors of the breast were regarded as carcinoma. When Cruveilhier first recognized the existence of benign tumors of the breast, a storm of opposition was raised in the French Academy of Medicine. Cruveilhier described a fibroma, but this name was not accepted and a multitude of terms was used. Johannes Mueller named it cysto-sarcoma-phylloides; Brodie called it serocystic sarcoma; Astley Cooper, hydatid tumor; Billroth, fibroma and cystosarcoma; Paget, chronic mammary and proliferous cysts. The diversity of nomenclature seems to have been due to the attempt to reduce the tumor to its component parts descriptively, i.e., to indicate in its terminology whether the stromal or epithelial elements predominated. Ribbert reached the most satisfactory solution of the difficulty by grouping the tumors, not as fibroma or adenoma, but as fibro-epithelial growth.

Periductal fibroma. There is a certain class of benign tumor which offers a fairly consistent picture under the microscope. This was called by Warren, as well as by others later, the periductal fibroma, with myxomatous and sarcomatous variations. It is commonly known as the intracanalicular adenofibroma. Greenough and Simmons have described it as a passive distortion of the epithelial elements of the gland by the growth of the connective tissue stroma, mainly the periductal tissue. When the ducts and acini are flattened to mere slits, by the stromal overgrowth, it is called intracanalicular adenofibroma.

Fibrocystadenoma or fibro-adenoma. The type of tumor closely related to the preceding one was called by Warren fibrocystadenoma and, in a recent classification by McFarland, fibro-adenoma. Horsley believes that this growth is always cystic, very often only microscopically, in the form of dilated acini. In this tumor the pathology suggests that the epithelial elements have become irritated or stimulated by a pre-existing stromatous hyperplasia. There is uncertainty of diagnosis in the minds of many, for several published series of benign breast tumors show striking differences in the incidence of this tumor. Warren gave the proportion as 1 per cent, Horsley as 35 per cent, and Greenough and Simmons as 25 per cent. It is difficult to differentiate this tumor from the condition known as chronic cystic mastitis or from abnormal involution, especially when the cysts in these processes are small, when there is little evidence of inflammation, and when they occur in young women.

Papillary cystadenoma. The growth known as papillary cystadenoma stands out fairly definitely with its cyst formation and proliferation of the epithelial lining into papillæ. It has long been looked upon with suspicion because of the occasional occurrence of bloody discharge from the nipple and the excessive hyperplasia of epithelial cells. Warren and Greenough and Simmons in 1907 studied 20 cases and found carcinoma associated in 15 per cent. In contrast to this, Hart in 1927 reviewed 124 cases and found no tendency toward malignancy in the 66 cases which he was able to trace from 10 to 30 years.

Chronic cystic mastitis. Lastly, the condition commonly called chronic cystic mastitis offers

difficulty in classification. There is good reason to believe that the term is a misnomer, a view firmly held by Cheatle of England who believes that the predominant feature of the condition, the hyperplasia of the epithelial element sometimes to the extent of two or three layers, does not mean a preceding inflammation as the term mastitis would indicate.

In the older writings on diseases of the breast there was frequent mention of "hydatid" and "echinococcus" cysts. Abernathy, Bill, and Copper supposed all cysts of the breast to be hydatid. Later, writers such as Brodie, Paget, and Virchow believed the cysts were formed because of obstruction of the ducts and called them retention cysts. Sir Benjamin Brodie first described the gross pathology and clinical findings in the condition now called chronic cystic mastitis or abnormal involution. At that time it went under no less than 23 different names, probably because of the three prevalent theories of etiology: inflammatory disturbance, neoplasia, and perversion of involution. Inflammatory signs such as pain, tenderness, transitory swelling; serous, milky, purulent or bloody discharge from the nipple; induration, cysts, lymphocytic infiltration and disturbance of the stroma, all pointed to an inflammatory basis of etiology, although apparently the normal breast itself may show signs suggestive of chronic inflammation. (The writers have been unable to find adequate microscopic studies of normal breast tissue at various ages in single, lactating, and parous women.)

The epithelial hyperplasia, degenerative tendencies, and the finding by some of carcinoma in as many as 15 per cent of cases led others to believe the condition neoplastic. (This figure is confusing, for in practically every case of breast carcinoma chronic mastitis may be found in some form or other. Similarly the picture of chronic mastitis may be seen associated with other tumors, especially the fibro-adenoma and papillary cystadenoma. Of 433 cases of breast tumor treated at this clinic, chronic mastitis was found alone or associated with another tumor in 90 per cent.) Bloodgood, however, thinks it too diffuse a process to be precancerous. The perversion of involution theory has found favor with some. Warren called it abnormal involution in describing the proliferation of acini with papillary outgrowths of epithelium into cysts, this adenomatous proliferation fusing to make a solid mass of cells. He found the latter in 15 of 517 cases of carcinoma with accompanying chronic cystic mastitis. (Papillary cystadenoma is apparently an advanced stage of this process.) The chief macroscopic lesion is the cyst, often in the small "blueberry" form; the chief microscopic lesion the proliferation of epithelium.

One point which must be kept in mind in the classification is the possibility of two fairly distinct processes existing in one tumor. A growth predominantly intracanalicular may show areas of adenomatous overgrowth and acinous dilatation that suggest a fibrocystadenoma. If the epithelium in these tissues shows one or more layers of hyperplasia, it is impossible to say that this is not an early chronic cystic mastitis. Whether the tumor described as fibrocystadenoma is a distinct entity or simply an early or late phase in the process of chronic cystic mastitis is one of the debatable questions. Its occurrence chiefly in younger women points to the former, but the presence of so much fibrous tissue and the frequent macroscopic cysts suggest the latter. Round cell infiltration is of little aid in this situation, because a large percentage of all the tumors in the series which follows showed this to greater or less degree.

Although Warren's general classification of benign breast tumors into periductal fibroma, fibrocystadenoma, papillary cystadenoma, and abnormal involution probably covers these tumors most broadly and accurately, in the following analysis the term chronic cystic mastitis is substituted for abnormal involution on the ground that the former is more commonly used. In his recent paper on benign breast tumor classification McFarland states that he found over half of a series of 289 cases studied by him to show no tumor microscopically, although the patients had all complained of a lump in the breast. In the present series this was found to be true when the strict pathological definition of tumor was applied. However, since all the lumps showed definite pathological changes and since the borderline

between abnormal breast changes and neoplasia cannot be defined, it seemed proper to regard all the lumps as tumors.

The following series comprises 201 cases of benign breast tumor of which 38 were private patients of Drs. William P. Graves and Frank A. Pemberton. Table I shows the number of cases according to the above classification:

TABLE I.—CLASSIFICATION

Tumor	Number of cases	Percentage of total
Periductal fibroma	57	28.3
Fibrocystadenoma	16	7.9
Papillary cystadenoma	14	6.9
Chronic cystic mastitis	114	56.7

(During the period covered by this series 234 cases of malignant breast tumors, 2.9 per cent of which were sarcomata, were treated at this clinic. This makes the proportion of malignant to benign tumors 1.19 to 1. During this same period four cases of tuberculous mastitis were treated by operation. They comprise 2 per cent of the benign tumors and 0.9 per cent of all the breast tumors. One of these died of pulmonary tuberculosis 2½ years after operation. The other three were well 1 year, 1 year and 7 months, and 13 years after operation respectively.)

HISTORY

Family. There was a family history of breast carcinoma in 6.1 per cent of the series, of malignant disease in 14 per cent, of tuberculosis in 13.4 per cent.

Past history. Sixty-one patients had had 97 operations of which 69 were pelvic. Two patients had had previous incision and drainage of breast abscesses. Those who had had previous removal of a breast tumor will be considered under recurrence.

Marital history. In the group with periductal fibroma 26 patients were single, 45.6 per cent. Six married patients had never been pregnant, 19.3 per cent. The average number of children per married patient was 1.9, of pregnancies, 2.5. In the fibro-adenoma group 8, 50 per cent, were single. The average number of children per married patient was 1.2, of pregnancies, 1.7. In the papillary cystadenoma group 14.2 per cent were single and 25 per cent of the married patients had never been pregnant. The average number of pregnancies per married patient was 3.1. Forty, 35 per cent, of the patients with chronic cystic mastitis were single. Seventeen of the married patients had never been pregnant, a sterility percentage of 23.6. The average number of pregnancies per married patient was 2.2, of children 1.7.

Table II shows the ages of onset of symptoms in the four groups:

TABLE II.—AGE INCIDENCE

	Periductal fibroma	Fibro-adenoma	Papillary cystadenoma	Chronic cystic mastitis
Under 20	13			
20 to 25	13	3	3	4
25 to 30	7	7		10
30 to 35	4	6	1	14
35 to 40	13		2	33
40 to 45	2		4	16
45 to 50	3		1	22
Over 50	2		3	15

TABLE III.—MENSTRUATION—PERCENTAGE

	Passed the menopause before onset of symptoms	Dysmenorrhœa	Menorrhagia	Metrorrhagia
Periductal fibroma	3.8	32.6	3.8	13.4
Fibro adenoma	0	35.7	0	28.5
Papillary cystadenoma	37.5	37.5	0	0
Chronic cystic mastitis	23.5	13.4	0	8.9

In those with chronic cystic mastitis the onset of breast symptoms seemed to be associated with the menopause in 20 patients, 5 of whom had had operative menopauses. Of the whole series 18 per cent were in the subinvolution or involution phase of reproductive life and 42.3 per cent of those who menstruated had some abnormality of menses.

TABLE IV.—SYMPTOMS—PERCENTAGE

	Periductal fibroma	Fibro-adenoma	Papillary cystadenoma	Chronic cystic mastitis
Lump	57.8	56.2	35.7	57
Tender lump	24.5	12.5	35.7	18.4
Lump, tender or larger before catamenia	14	31.2	14.2	7.09
Lump, and discharge from nipple	0	0	14.2	7.01
Discharge from nipple	0	0	0	1.7
Lump, varying in size	1.7	0	0	5.2
Trauma followed by lump	3.5	0	0	1.7

Lump appearing during and disappearing after pregnancy, 0.8 per cent. Six patients had never noticed a lump in the breast, operation being performed coincidentally with that for a pelvic condition after discovery of the mass during routine physical examination. Seven had the opposite breast involved without knowing it. Of the 48 patients with pain in the tumor 6 stated that it began some months before the mass was noted; 6 mentioned it as beginning after the mass was felt.

The duration of the complaint varied from a few days to 20 years. The average duration is divided among the groups as follows: periductal fibroma, 2½ years; fibrocystadenoma, 1 year; papillary cystadenoma, 2½ years; chronic cystic mastitis, 1 year and 9 months. A striking difference in duration before coming for treatment was noted between the private patients and those treated in the Free Hospital. In the former group it was a matter of a few weeks, often days, with 2 or 3 of longer duration bringing the average up to 5 months as compared with 1 to 2 years in the latter group.

OPERATION, PATHOLOGY, AND RESULTS

The surgical procedures were: simple resection of the breast, subcutaneous amputation of the breast, simple amputation and radical amputation which included dissection of the axilla.

Periductal fibroma. In this group (57 cases) the primary operations were: resection of one breast, 43; resection of both breasts, 2; subcutaneous amputation of one breast, 1; simple amputation of one breast, 5; radical amputation of one breast, 5; resection of one breast and simple amputation of the other, 1.

The typical periductal fibroma was the only pathological finding in 22 cases. Chronic mastitis was found associated with it in 28 cases. Unmistakable sarcoma was present in 4 cases, probable sarcoma in 3 (in these the tumors were more active than usually found, but could not be called frank sarcomata; they rank in the same category with some of the low malignancy leiomyosarcomata of the uterus).

One of the 4 patients with definite sarcoma died of pulmonary embolism 5 days after operation. She was 35 years old. The second, who had had primary resection of the breast and simple amputation 2 years later for recurrence at another hospital, had the pectoral muscles removed and the axilla cleaned out at this hospital 3 years after the first operation and is now untraceable. The third patient died of recurrence 1½ months after radical operation. The last patient died 5½ years after her first operation, a simple amputation, having had in all 27 operations for recurrences. Two of the probable sarcoma cases are untraceable; the third was well 11 years after radical operation.

Of the remaining 50 cases in this group 13 are untraceable. One patient died of melanotic sarcoma (from a pigmented mole of right axilla) 1 year, 4 months after operation, having had no further breast trouble. Twenty-nine patients were well at the time of follow-up. They are tabulated as follows: well 6 months to 1 year later, 3; well 1 to 2 years later, 5; well 2 to 3 years later, 2; well 3 to 5 years later, 6; well 5 to 10 years later, 4; well 10 to 15 years later, 9.

Seven periductal cases (21.2 per cent of those traceable more than 1 year) had further breast trouble. Of the 6 tumors recurrent in the same breast 5 were periductal fibromata and one a chronic cystic mastitis. Five of these 7 also had tumors of the opposite breast removed (periductal fibroma, 2; fibro-adenoma, 1; chronic cystic mastitis, 1, unknown, 1). Bilateral recurrent nodules were present in 1 case 10 years after the second bilateral resection. The other patients were well 3 to 20 years later.

In 5 patients the tumor was bilateral at the time of operation or became so later. Six of the 7 patients who had children after operation experienced no difficulty in nursing, from the breast operated upon. The seventh had no milk in the breast operated upon, recurrent tumor being present. Another patient had a normal pregnancy and labor after both breasts had been amputated. Although she was unable to nurse, she stated that a few nodules formed in the amputation scars following delivery.

Fibro-adenoma. Of 16 cases in this group 14 had unilateral resections, one unilateral subcutaneous amputation, and one unilateral radical amputation. Fibro-adenoma was the only pathological finding in 8 cases; it was associated with chronic cystic mastitis in the other 8.

Four of this group are untraceable. Eight patients were well and had had no further breast trouble 3, 6, 6, 8, 10, 10, 11, and 11 years after operation, respectively. Four patients (33.3 per cent of those traceable) with later trouble are briefly summarized:

1. Symptomless lump in scar and a lump in opposite breast, which increased in size and became tender before menstruation, 1 year and 5 months after a subcutaneous amputation.

2. Small lump in same breast, which enlarges and becomes sore before catamenia, 2 years and 9 months after operation.

3. Lump and inflammation in same breast following trauma 13 years, 4 months after resection.

4. Radical amputation of opposite breast for carcinoma 20 years after a simple resection. Well 1 year later.

One patient nursed three infants without difficulty following unilateral resection.

Papillary cystadenoma. Of 14 patients in this group, 5 had resections, one a simple amputation and 8 radical amputations, all unilateral. Papillary cystadenoma and chronic mastitis were found together in 10 cases. In the other 4, 28.5 per cent, carcinoma was also present.

One of the carcinoma patients is untraceable; one was alive with a recurrence 1 year after operation. The third had a recurrence excised 7 years after operation and was well 5½ years later. The fourth had a recurrence excised 8 years, 8 months later and was well 20 years after the first operation.

Of those cases without carcinoma, 3 are untraceable. One patient died of cerebral hæmorrhage 5½ years after operation, having had no later breast disturbance. Five patients were well 1 to 10 years later. Amputation of the opposite breast for chronic cystic mastitis was performed on one patient 3 months after primary operation and she was well 1 year, 3 months later.

Chronic cystic mastitis. 114 cases. In this group there were 58 unilateral resections, 9 bilateral; 10 subcutaneous amputations, 1 bilateral; 21 simple amputations, 4 bilateral; and 6 radical amputations; resection of one breast and amputation of the other, 1; resection of one, subcutaneous amputation of the other, 2; resection of one, radical amputation of the other, 2.

In 4 cases one or two small areas of the periductal type of growth were found. All the others showed chronic cystic mastitis and 2 of these showed also carcinoma and chronic mastitis in the opposite breast which was removed radically at the same operation.

Twenty-six patients are untraceable. One of the remainder died of recurrent carcinoma of the breast 1 year after operation. The following 62 had no further breast trouble: 1 to 2 years after operation, 12; 2 to 3 years after operation, 7; 3 to 5 years after operation, 11; 5 to 10 years after operation, 11; 10 to 15 years after operation, 15; 15 to 20 years after operation, 6.

Fourteen patients had subsequent operations on the same or both breasts for chronic mastitis 1 to 20 years after the primary conservative operation. One died of carcinoma of the stomach 4 years after the second operation; another died of pulmonary tuberculosis 11 years after her third breast operation. One patient complained of pain and lumps in her breasts 10 years after her second bilateral resection. Six, with later follow-up, were well 3 to 19 years after the last operation.

Two patients had a lump in the same breast 1 and 5 years after operation, but did not undergo another operation.

One patient complained of a lump in the opposite breast and 6 had operation on the opposite breast for mastitis 2 months to 10 years after their first operation. Four of these were well 2 to 10 years after the second operation.

Two patients had carcinoma of the breast at a later date. One of these had resection of the left breast for chronic cystic mastitis 6 years after resection of the right breast for the same trouble. Bilateral simple amputation 15 years after the second operation revealed carcinoma in the left breast. She is now well 5 years after the removal of the carcinoma. The other had a radical operation on the right breast for carcinoma 3 years, 5 months after a bilateral resection and died of recurrence 6 months later. (It is not improbable that this patient had carcinoma at the primary operation, but the disease could not be found in the excised specimen.)

In 31 cases the process was bilateral at the primary operation or became so later. This makes the percentage for bilateral involvement at least 27.1. (Some untraceable cases probably had recurrences.) Two patients had

later pregnancies and found no difficulty in nursing from the operated breasts.

SUMMARY AND CONCLUSIONS

1. Benign breast tumors are discussed and a résumé of 201 cases is given.

2. Fifty-five per cent of the series had never nursed. It is not known how many of those who had children did not nurse.

3. The majority of the periductal fibroma cases were under 30 years of age when symptoms were noticed. All of the fibro-adenoma cases were under 35. Most of the papillary cystadenoma and chronic cystic mastitis patients were over 35.

4. Abnormality of menstruation was complained of by 42.3 per cent of those who had not passed the menopause. Eighteen per cent of the series were near, at, or had passed the menopause when symptoms began.

5. Changes in the affected breast or breasts associated with menstruation were noted by 13.7 per cent.

6. Discharge from the nipple was complained of by 14.2 per cent of the papillary cystadenoma cases and 8.8 per cent of the chronic mastitis cases.

7. The duration of symptoms bore no relation to the extent or seriousness of the lesion.

8. Sarcoma was found at the primary operation in 7 per cent of the periductal cases. Carcinoma was present in 28.5 per cent of the papillary cystadenoma group and in 1.7 per cent of the chronic mastitis cases. Thus ten, 4.9 per cent of the whole series, had associated malignant breast disease at the primary operation. Three patients (one of the fibro-adenoma class and two of the mastitis group) had breast carcinoma at a later date. These make 1.9 per cent of the traceable cases.

9. Bilateral involvement occurred in 13 per cent of the periductal cases and in 35.2 per cent of the chronic cystic mastitis cases.

10. Later benign breast disease occurred as follows: periductal (21 per cent of the whole group had had one breast amputated at the first operation), 21.2 per cent; fibro-adenoma (12.5 per cent had had one breast amputated), 25 per cent; papillary cystadenoma (64.2 per cent had had one breast amputated), 10 per cent; chronic cystic mastitis (36.8 per cent of the group had had one breast amputated at the first operation), 27.7 per cent. Possibly the high percentages of recurrence are accounted for by insufficient removal of tissue at the primary operation.

11. The difference between normal and pathological breast tissue is extremely difficult to define even when a lump is present grossly. Probably many pathological breasts are unnoticed or neglected (for example abnormal tenderness or a diffuse chronic mastitis with slight induration) until a lump appears. This will be benign in 49 instances and malignant in 51, depending on the presence or absence of the unknown biological factors that are associated in cancer production.

12. The benign breast tumors have a close pathological relationship to each other. Furthermore, not only are they associated with the whole cycle of ovarian and reproductive life, but more especially with lack of normal breast function and with involution—factors which result in stasis and lack of drainage.

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FIBROMYOMA OF THE UTERUS IN RELATION TO PREGNANCY

WITH REPORT OF CASES[1]

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FIBROMYOMATA of the uterus have caused sterility, have produced abortions and premature labors, and have caused serious complications during pregnancy, labor, and the puerperium. Myomectomy has made pregnancy possible for women who were sterile on account of fibroids, and myomectomy for fibroids which became degenerated or twisted during pregnancy has saved mother and unborn child from disaster. The relations between fibromyoma of the uterus and pregnancy are of interest to surgeons and obstetricians. It has, therefore, seemed worth while to summarize these relations, to give statistics of 147 women for whom fibromyomata were removed by the writer, and to report 5 cases in brief detail.

Uterine fibromyomata may prevent pregnancy by obstructing the cervix or the uterine cavity and by altering the glandular or vascular structure of the endometrium. Sterility is said to be twice as frequent in married women with uterine fibroids as in married women in general who come under medical care (Lynch). Statistical studies of sterility in married women who have fibromyomata of the uterus often give results which are conflicting and unsatisfactory, because important causative factors as the menopause, widowhood, determination not to have children, and co-existing disease of both fallopian tubes or ovaries, are not given due consideration.

The co-existence of pregnancy and uterine fibromyoma is most often found in women between the ages of 25 and 45 years. Fibromyomata clinically important from their size and situation were present in 191 cases among 30,836 pregnant women considered by Pierson, an incidence of 0.6 per cent. Of these pregnant women with complicating fibroids, 16 per cent aborted or had premature labor on account of the tumors. In a collected series of 2,274 operations for uterine fibromyoma, Noble found 13 cases of pregnancy and 7 cases of ectopic pregnancy.

During pregnancy, fibromyomata usually increase in size and become softened and sometimes flattened, and change in position as the uterus enlarges. They may remain fixed in the pelvis by impaction or by adhesions, and cause abortion at the third or fourth month of pregnancy. After parturition the tumors return to their former volume or even to smaller size, but they may, in some instances, grow more rapidly.

Urgent symptoms during pregnancy are caused by a fibromyoma when it degenerates, becomes infected, or has its circulation partially or completely interrupted by torsion. Necrosis and even suppuration may occur in a fibromyoma (Loubat, Frank, Collins, Duvergey). Dangerous intraperitoneal hæmorrhage may be caused by the rupture of varicose veins on the surface of a large fibroid (Ransohoff). Hoffmann has reported a successful operation in a primipara 25 years old in whom rupture of a vein on the surface of a myoma occurred on the second day postpartum.

Gross degeneration is found in approximately 13 per cent of the fibromyomata removed at operation. Among 200 degenerated fibromyomata examined by Seed, there were 12 infected submucous tumors and 3 infected tumors which were subserous or interstitial.

Pyogenic foci have been observed in myomata which macroscopically were of normal structure and showed no regressive change (Klafton). Bacteriological examination of infected myomata has shown as infecting organisms in different cases: streptococcus, staphylococcus, pneumococcus, micrococcus, gonococcus, colon bacillus (Collins), and Welch bacillus (Spencer).

Small interstitial tumors, and some large tumors of the upper part of the uterus, may produce no serious difficulty during pregnancy or delivery. A woman, reported by Huet, was delivered of her eleventh child without hæm-

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orrhage and without obstetrical intervention, in spite of the presence of a large sessile fibromyoma of the fundus of the uterus. The tumor weighed 5 kilograms when removed by hysterectomy 6 weeks after delivery.

A large fibromyoma of the posterior uterine wall, lying in the pelvis, may recede out of the pelvis, during labor, permitting delivery. This happened in case reported by Homans—the tumor weighed 2½ pounds and was 6 inches in diameter when removed a few weeks later.

Tumors which deform the uterus greatly increase the incidence of abnormal presentations and positions of the fetus. Normally 95 per cent of presentations are vertex, but in a fibromyomatous uterus, only 54 per cent of the presentations are vertex, 24 per cent are breech, and 19 per cent transverse (Noble). In vertex presentations, fibroid tumors may cause occipitoposterior positions and, in these positions, injuries to the child during delivery occur five times more frequently than in occipito-anterior positions (Kerr).

A fibromyoma of the lower uterine segment or of the cervix may displace the cervix and offer serious obstruction to labor. When there is such obstruction, delivery by version or with forceps may injure the child, rupture the uterus, or bruise the tumor. The damaged tumor may then undergo degeneration or become infected and gangrenous.

Submucous fibroids apart from pregnancy are often extruded through the cervix. They may prolapse during pregnancy, labor, or the puerperium, and may even invert the uterus.

Fibromyomata may cause placenta prævia. Low implantation of the placenta has been found present in 35 of 53 cases investigated at the Baudelocque Clinic in which there was co-existence of fibromyoma and pregnancy. This low implantation not infrequently leads to hæmorrhage from partial separation of the placenta (Mialiniak). Severe postpartum hæmorrhage may occur when the placenta has been implanted over a tumor. Retention of the placenta and membranes in whole or in part, after delivery of the child, may result from adhesions to a fibroid or from obstruction of the birth canal by a tumor.

By lessening the effectiveness of the uterine musculature, fibromyomata may cause inertia. They rarely, if ever, cause spontaneous rupture of the uterus during labor. They may delay involution after delivery, especially when the uterus becomes retroverted.

Fibroid tumors may cause the death of a fetus by direct compression, or by lessening its nutrition through the placenta. The fetal mortality in pregnancies complicated by fibroids is high, because of the frequent occurrence of abortion and premature labor, the prematurity of the fetus in cæsarean operations undertaken before full term, and the accidents connected with obstetrical maneuvers during delivery.

Fetal malformations have been found in cases in which pregnancy was complicated by fibromyoma (Voron, Harris, Case 3). In most cases, it is probable that the fetal malformations will not be found to be directly caused by the presence of the uterine tumors.

Fibromyomata of the uterus may produce pressure upon the colon during pregnancy, leading to fæcal stasis and toxæmia. The tumors, by pressure upon the bladder and ureters, may cause urinary stasis, a condition often complicated by cystitis and pyelonephritis. According to Hartmann and Bonnet urinary retention is more often caused by fibromyomata of the posterior surface of the cervix or of the retroverted body of the uterus, than by those tumors of the anterior wall which are in direct relation with the bladder.

The diagnosis of fibromyoma and of pregnancy, separately or combined, at times offers great difficulty. Ease of diagnosis of fibromyoma depends upon appreciable size and accessible position of the tumors and irregularity of the uterus. Pyosalpinx and ovarian or parovarian cysts are at times difficult to distinguish from tumors of the uterus. Early pregnancy in a large fibroid uterus may easily escape recognition. A dead fetus may be mistaken for a degenerating interstitial fibromyoma; and in several recorded cases a fibromyomatous uterus has closely simulated a pregnant uterus (Spencer, Bevan, Hartmann, Colella).

When pregnancy occurs in a uterus containing fibroids, a large tumor of the anterior wall may prevent palpation of the fetus and

auscultation of the fetal heart (Kerr). During the later months of pregnancy, the presence and presentation of the fetus may if necessary be demonstrated by X-ray examination. When the diagnosis is in doubt and there are no urgent symptoms, re-examination after a lapse of time may often be depended upon to make matters clear. Digital examination through the rectum sometimes gives information not otherwise obtained.

Curettage of the uterus may be done in cases of fibromyoma with metrorrhagia in which there is the possibility of a recent early abortion. Curettage in such a case may control the bleeding, permit recovery from severe anæmia, and make subsequent hysterectomy safer.

The possibility that a fibromyoma may be malignant and that carcinoma may be present in the endometrium must be remembered in doing myomectomy for the relief of sterility. When carcinoma is suspected in the course of an abdominal myomectomy in a non-pregnant woman, the uterus should be opened by hysterotomy and the endometrium examined. If a malignant myoma is encountered in doing myomectomy, hysterectomy should be performed. Malignant myomata are found in about 0.6 per cent of the cases in which women submit to operation for fibromyoma of the uterus (Evans). Nisot has reported a case of enormous sarcoma of the uterus complicating pregnancy, in which he performed hysterectomy at the fourth month of pregnancy.

Some myomectomy patients have after several years developed new fibroids, necessitating hysterectomy (Boldt, Keiffer), but at this later period of menstrual activity the operatively induced menopause was of less consequence than it would have been at the time of the first operation.

Myomectomy undertaken for the relief of sterility has frequently been followed by pregnancy and the delivery of a living child. Lefebvre in 1922 was able to find records of 125 women who became pregnant subsequent to myomectomy. McCosh has reported first pregnancies in 3 women from 30 to 38 years of age, for each of whom he had removed by abdominal myomectomy tumors weighing several pounds. Twenty-three married women sterile before myomectomy performed at the Mayo Clinic have each had 1 or several children since the operation (W. J. Mayo). Goullioud, who has reported 15 cases of pregnancy after abdominal myomectomy, holds that myomectomy offers at least a 25 per cent chance of subsequent pregnancy to married women less than 40 years of age who desire children but are rendered sterile by fibromyoma.

Before undertaking myomectomy for the relief of sterility for a woman desirous of having children, the surgeon should give due consideration to any existing conditions which might make subsequent pregnancy unsafe, such as mitral stenosis, arterial hypertension, chronic nephritis. In deciding upon myomectomy, he should reserve the right to do hysterectomy, in view of the fact that operation may disclose malignancy of tumors, disease of both ovaries or of both tubes, or impossibility of reconstructing a uterus safe for pregnancy.

Pregnancy develops normally in women who have had a myomectomy, and abortions are no more frequent than among other women. Labor in women who have had a myomectomy has not been found seriously modified by the scar in the uterine wall. In 100 deliveries in pregnancies following abdominal myomectomy, there were 96 normal cephalic, 1 face, and 3 breech presentations (Benoît-Gonin quoted by Lefebvre). Uterine rupture during labor after myomectomy is rare. The scar of myomectomy like the scar of cæsarean section may, however, weaken the uterine wall or may interfere with the action of its musculature. A primipara who has had myomectomy may on account of age be slow in labor and require obstetrical or surgical assistance. She should, therefore, have the benefit of hospital care during labor and so long as necessary thereafter.

Myomectomy during pregnancy has usually been performed on account of the degeneration, torsion, impaction, or large size of a fibromyoma. Of 23 women for whom myomectomy was performed during pregnancy at the Mayo Clinic, 16 had intra-uterine pregnancy and 11 of these were delivered of living children at full term (W. J. Mayo). Cotte

and Creyssel collected 85 myomectomies during pregnancy, 83 abdominal and 2 vaginal, performed between 1904 and 1922. In 65 of the cases the pregnancy was not interrupted. Only 1 of the women died, the death being due to pneumonia. In 35 of the patients the record extended to the birth of a living child, and there was no case of uterine rupture in the series. In 14 cases, myomectomy was followed by abortion.

Multiple fibromyomata have been safely removed by myomectomy during pregnancy, but it would seem wiser to remove during pregnancy only the tumors which cause urgent symptoms or which threaten disaster.

Pedunculated subserous fibroids are more easily removed from the pregnant uterus than are those which are sessile or intramural. Interstitial fibromyomata have been removed without interruption of pregnancy, even when the placenta and membranes were exposed during the myomectomy, and in one case (Roullaud) even when the membranes were transfixed by suture.

Myomectomy for a fibromyoma of large size growing from the posterior aspect of the lower uterine segment and causing impaction of the pregnant uterus, is difficult, and carries a large chance of interruption of the pregnancy; but without surgical interference in such a case, abortion is practically inevitable. Tumors of the posterior uterine wall may in some cases be removed from the cul-de-sac by the transvaginal route during pregnancy, but on account of the difficulty of dealing with the wound in the uterus, it will be safer in most cases to remove such tumors in connection with cæsarean section at or near term.

Small submucous fibroids prolapsing into the vagina during pregnancy are easily excised. Large tumors may require subdivision to permit removal. When the pedicle may be divided under the guidance of a finger, a fibromyoma tightly filling the vagina may be delivered intact by incision of the perineum and repair after extraction of the tumor.

Obstructing fibromyomata of the cervix will in most cases be more easily dealt with after cæsarean section at term.

In general, those fibromyomata should be removed during pregnancy which endanger the life or health of the mother, which threaten abortion and death of the fetus, which degenerate or undergo torsion, which seriously obstruct the intestinal or urinary tracts, or which obstruct the path of delivery. Spencer holds that total abdominal hysterectomy should be performed when subperitoneal or intramural fibroids are found infected. Collins has, however, reported the performance of myomectomy without interruption of pregnancy in a case in which there was colon bacillus infection of the tumor.

When normal delivery is possible, without serious danger, in spite of the presence of a uterine fibromyoma, the performance of myomectomy or of hysterectomy may be deferred until after delivery. Hysterectomy during pregnancy should be performed only when myomectomy cannot save the patient from the accidents due to the myoma or when the tumor is infected or malignant, and the operation will seldom be performed during pregnancy except in connection with cæsarean section at or near term.

STATISTICS

Consecutive case records of 147 women for whom uterine fibromyomata were removed by the writer, were arranged and numbered chronologically in groups according to the kind of operation performed:

1 to 45, 45 abdominal myomectomies;
46 and 47, 2 vaginal myomectomies;
48 to 50, 3 transvaginal myomectomies;
51 to 131, 81 supravaginal hysterectomies;
132 to 140, 9 complete abdominal hysterectomies;
141 to 147, 7 vaginal hysterectomies.

Among the 50 myomectomy patients, there was one death, a death caused by pulmonary embolism on the fifth day in a case of large gangrenous ovarian cyst, in which the myomectomy was incidental. There were 4 deaths among the 97 hysterectomy patients: they were due to the following causes: (a) peritonitis from breaking of infected ovarian cyst during supravaginal hysterectomy (Case 65); (b) peritonitis following supravaginal hysterectomy and relief of extensive peritoneal and

TABLE I.—DISTRIBUTION OF PATIENTS BY OPERATION AND SOCIAL STATE

Operation	Married	Widowed	Single	Total
Myomectomy	32	3	15	50
Hysterectomy	78	5	14	97
Total	110	8	29	147

TABLE II.—DISTRIBUTION OF PATIENTS BY OPERATION AND AGE

Age in years	Myomectomies	Hysterectomies	Total
Not more than 25	1	0	1
26 to 30	4	4	8
31 to 35	13	7	20
36 to 40	10	20	30
41 to 45	13	24	37
46 to 50	4	23	27
51 to 55	3	15	18
56 years or more	2	4	6
Totals	50	97	147

omental adhesions (Case 83); (c) surgical shock following complete abdominal hysterectomy in a patient with arterial hypertension (Case 132); (d) peritonitis following complete hysterectomy in a patient with procidentia, large fibromyoma, and anæmia (Case 136).

The myoma patients who had operations are classified according to operation and social state in Table I, and according to operation and age in Table II. From the second table, it will be seen that two-thirds of the myomectomies were in women from 31 to 45 years old, and two-thirds of the hysterectomies were in women from 36 to 50 years of age.

The obstetrical experience of 147 patients who had operations for fibromyoma is given in Table III. Twenty-nine women were unmarried; and 43 married women had no children. Of 75 women to whom a total of 168 children were born, 18 women were sterile at the time of operation for fibromyoma, as shown by the finding of double hydrosalpinx or pyosalpinx in the 18 cases (Cases 7, 45, 51, 57, 78, 86, 87, 89, 103, 108, 109, 116, 122, 128, 131, 133, 139, 147).

The 50 myomectomy patients are classified according to social state, age, and sterility in Table IV. From this table it will be seen that only 3 myomectomy patients were married, less than 40 years of age, and apparently sterile on account of uterine fibroids. One of these 3 women subsequent to operation was delivered by cæsarean section of a normal living child at term. This represents at least a 33⅓ per cent chance of pregnancy after myomectomy for married women less than 40 years of age who are sterile on account of fibroids and desirous of having children. Goullioud considers this chance to be at least 25 per cent.

Data concerning 50 married women with large uterine fibromyomata, in reference to sterility and fertility, are shown in Table V. There was only 1 death in this series (Case 136). Among the 50 cases were found 10 women with hæmoglobin from 18 to 50 per cent, 9 women with double hydrosalpinx, 2 women with large benign ovarian cysts, 1 woman with carcinoma of both ovaries, 1 with malignant myoma, 1 with carcinoma of the uterus, 1 with infected gangrenous myoma, 2 with calcified myoma, 2 women pregnant at the time of operation, 2 with procidentia, 1 woman yet menstruating at 58 years of age, and 2 women who required hysterectomy after previous myomectomy.

Of the 50 women, 5 had myomectomy, 45 had hysterectomy; 5 were widowed, 7 were past the menopause.

The average age of 50 patients at operation was 44.36 years; the average age of 50 patients at marriage was 22.8 years; and the average duration of co-existing married state and menstrual activity 20 years.

Twenty women had children and no abortions, 8 had children with abortions, 5 had abortions or miscarriages only, 17 had no pregnancies, and the total number of children was 70, an average of 1.4 children for 50 patients.

Of 28 women who had children, 10 had had more than 2 children. The average for the 28 women was 2.5 children.

Of 28 women who had children, 18 had had no children for 10 years prior to operation, menopause, or widowhood.

Of 17 women who had had no pregnancies, 3 had bilateral hydrosalpinx and 2 had bilateral ovarian tumors. This leaves among the 50 married women with large uterine fibromyomata, 12 women who had had no pregnancies apparently because of the presence of fibroids.

CASE REPORTS

CASE 1. Myomectomy in a woman who had never been pregnant; pregnancy and delivery at term of a living child by cæsarean section 16 months later.

Mrs. V. M. A., aged 35 years, had been married 8 years and had had no pregnancies, although desirous of having children. She had had menorrhagia and anæmia for 3 years on account of multiple fibromyomata of the uterus. Hæmoglobin, 60 per cent; erythrocytes, 2,750,000 per cubic millimeter; leucocytes 7,850 per cubic millimeter. January 17, 1923, she had appendectomy and myomectomy performed. One interstitial fibromyoma of the fundus of the uterus, the size of an orange, two submucous fibromyomata 1 inch in diameter, two smaller submucous tumors, and three small interstitial tumors were removed. The hysterotomy wound was sutured in layers. Convalescence was without complications. The patient became pregnant in August, 1923, and on May 27, 1924, she was delivered by cæsarean section, which was necessitated by persistent occipitoposterior position of the presenting head with incomplete dilatation after 24 hours of labor. The fear of possible rupture of the uterus prevented the doing of version or other obstetrical maneuver. The child was a normal male child weighing 7 pounds, 14 ounces. There were no complications. In December, 1928, the mother was well although she was still anæmic. The boy was thriving.

CASE 2. Myomectomy in a woman who had had one abortion at 3 months; pregnancy and delivery of living child at term 3 years after operation.

Mrs. Z. E. B., aged 34 years, had been married 8 years, and had had only one pregnancy, in which she aborted at the third month when 31 years old. She came for repair of a right inguinal hernia and the removal of multiple fibromyomata of the uterus. Because she was desirous of having children, she refused hysterectomy. April 9, 1920, right inguinal herniotomy, appendectomy, and myomectomy were performed. Eleven fibromyomata were removed, one pedunculated tumor of the fundus 2 inches in diameter, 3 interstitial tumors 1 inch in diameter, and 7 smaller interstitial tumors. There were no complications. In 1921 she had menorrhagia for 3 months. Examination October 19, 1921, showed the uterus retroverted and large, but no fibroids were palpable. The condition was corrected by systematic taking of the knee-chest position. The patient became pregnant in July, 1922, and on April 4, 1923, she was delivered of a normal female child weighing 8 pounds, 5 ounces. Persistent right occipitoposterior position of the presenting head led to delivery by podalic version.

In December, 1928, the mother was well and the daughter thriving.

CASE 3. Myomectomy at the sixth month of pregnancy; abortion of dead deformed fetus 24 hours later; subsequent pregnancy and delivery of living normal child at term.

TABLE III.—OBSTETRICAL EXPERIENCE OF 147 PATIENTS WHO HAD OPERATIONS FOR FIBROMYOMA

	No. of women
Never married	29
Had had full term pregnancies and no abortions, with a total of 123 children	52
Had had full term pregnancies and one or more abortions, with a total of 45 children and 28 abortions or miscarriages	23
Had had only abortions or miscarriages, with a total of 9 uterine abortions and 1 tubal abortion	9
Married women, never pregnant	34

TABLE IV.—DISTRIBUTION OF MYOMECTOMY PATIENTS BY SOCIAL STATE, AGE, AND STERILITY

Single	15
Married (11 less than 40 years of age)	32*
Widowed	3
Total	50
*Of 11 married women less than 40 years of age	
Had had children	5
Sterile because of hydrosalpinx	1
Had never been pregnant	3
Sterile on account of fibromyoma alone, became pregnant after myomectomy, and was delivered of living child (Case 1)	1
Had had one abortion, no children, but after myomectomy, pregnant, delivered of living child (Case 2)	1
Had had one abortion, pregnant at time of myomectomy, aborted, became pregnant and was delivered of living child (Case 3)	1
Myomectomy during first pregnancy; delivered of living child at term (Case 4)	1

Mrs. E. W., 34 years old, had been married 9 years, was without children, and was pregnant when she came to the hospital May 9, 1924. She had had dilatation of the cervix and had worn a stem pessary for the relief of dysmenorrhœa. An incomplete accidental abortion at the third month of pregnancy in 1917 had required curettage of the uterus. Since puberty at 13 years of age, the menstrual periods had recurred regularly at intervals of from 33 to 35 days, with scanty flow for 3 days. There had been no leucorrhœa. The last menstrual period had begun November 16, 1923, and the patient was almost 6 months pregnant. Following a long automobile ride May 7, 1924, she began to have painful uterine contractions at intervals of one-half hour and escape of blood from the vagina. There was pain in the right half of the pelvis. On examination the uterus was found to correspond in size to less than the calculated 6 months of pregnancy, and there was a hard, small mass to the right of the cervix apparently in the broad ligament. It was thought probable that the uterine contractions had forced one or both feet of the fetus through a ruptured area of the lower uterine segment.

At operation May 8, 1924, an irregular uterine fibromyoma of the shape of a foot was found in the right broad ligament closely applied to the cervix.

TABLE V.—DATA CONCERNING STERILITY FOR FIFTY MARRIED WOMEN WITH LARGE UTERINE FIBROMYOMATA

Case number	Patient's initials	Date of operation	Diameter in centimeters of uterus or largest tumor	Weight in grams of uterus or largest tumor	Age at operation	Age at marriage	Age at menopause	Age when widowed	Years married during menstrual activity	Number of children	Number of abortions and miscarriages	Age at birth of last child	Interval between last child and operation	Remarks
11	N.D.	4-21-20		237.	48	27			21	0	0			Menorrhagia-Hæmoglobin 66%
18	E.C.	6-29-20	7.5		42	23		39	16	0	2			Menorrhagia-Hæmoglobin 64%
23	E.R.	10- 8-22	10.		50	19	46		27	0	0			Cerobrospinal multiple sclerosis
32	D.D.	2-13-24		510.	41	33			8	0	0			Subsequent hysterectomy
38	E.H.	4-21-26		396.	35	27			8	0	0			Pregnant at time of operation. Delivery at term
57	M.H.	10- 3-18		650.	40	20			20	1	1	?		Double hydrosalpinx
59	B.K.	12-29-18	10.		39	21			18	2	0	31	8	Menorrhagia
61	N.P.	3-27-19	7.5		39	21		30	9	0	0			Left ovary 90 gms. Right ovary 752 gms.
62	F.P.	3-28-19		575.	39	21			18	1	0	30	9	Left ovarian cyst 84 grams
63	E.B.	5-22-19		747.	53	21	52		31	4	0	30	23	Past the menopause
64	C.B.	9- 2-19	12.5		45	22		40	18	7	0	36	9	Hæmoglobin 80%
66	L.C.	1-27-20	6.5		51	25			26	2	0	35	16	Menorrhagia-Hæmoglobin 40%—Gangrenous submucous fibromyoma
69	E.W.	3-22-21		615.	45	30			15	0	0			Menorrhagia
72	L.B.	3- 5-22	6.5		42	20			22	1	0	23	19	Menorrhagia
73	E.M.	3-31-22	15.		46	21			25	3	0	33	13	Menorrhagia
74	E.C.	8-20-22		960.	44	·20			24	0	0			Menorrhagia-Hæmoglobin 35%
75	V.W.	9-12-22	15.		48	19 & 35			29	0	0			Fibromyomatous uterus extended to umbilicus
78	M.K.	5- 4-23	10.		55	21	52		31	1	0	22	33	Double hydrosalpinx
79	F.R.	6—4-23	12.5		31	17			14	3	1	27	4	Patient thought she was pregnant
82	M.M.	12-12-23	10.		45	30			15	0	0			Retrocervical fibromyoma filling pelvis
86	A.R.	4- 2-24	7.5		34	18			16	0	1			Double hydrosalpinx
90	W.R.	8-28-24	10.		48	32			16	0	0			Menorrhagia-Hæmoglobin 48%
91	L.B.R.	9- 2-24	10.		48	16			32	3	1	27	21	Menorrhagia-Hæmoglobin 42%
93	H.E.	9-22-24		715.	45	20			25	2	0	33	12	Necrobiosis of fibromyoma
96	M.B.	11- 6-24		625.	33	28			5	0	0			Ovarian cyst 112 grams
99	E.H.	6-19-25	10.		52	29	48		19	0	1			Past the menopause
100	F.H.	7- 6-25		810.	54	22	51	24	2	1	0	23	31	Calcified fibromyomata
102	M.S.	8-10-25		2250.	45	18			27	4	0	34	11	Main mass a pedunculated myoma. Menorrhagia-Hæmoglobin 52%
103	M.C.	8-15-25	12.5		41	17			24	0	0			Double hydrosalpinx
107	E.P.	10- 9-25		1020.	34	26			8	0.	0			Leucorrhœa. Pain at periods
108	E.L.H.	6-16-26	20.	1755.	39	26			13	2	0	33	6	Double hydrosalpinx
109	M.C.	6-30-26	10.		45	19 & 28			26	0	1 tubal			Double hydrosalpinx
110	E.D.	7-26-26		2040.	53	21		42	21	2	0	24	29	Menorrhagia-Hæmoglobin 30%
111	F.C.	8-19-26	12.5		47	26			21	0	0			Menorrhagia-Hæmoglobin 18%
114	M.H.	10-27-26		395.	44	16 & 43			28	2	0	25	19	Intermenstrual bleeding for 2 years
116	B.R.	4-27-27		1230.	38	31			7	0	0			Double hydrosalpinx

TABLE V.—DATA CONCERNING STERILITY FOR FIFTY MARRIED WOMEN WITH LARGE UTERINE FIBROMYOMATA—*Continued*

Case number	Patient's initials	Date of operation	Diameter in centimeters of uterus or largest tumor	Weight in grams of uterus or largest tumor	Age at operation	Age at marriage	Age at menopause	Age when widowed	Years married during menstrual activity	Number of children	Number of abortions and miscarriages	Age at birth of last child	Interval between last child and operation	Remarks
118	V.D.	9- 8-27	6.5		36	18			18	2	0	25	11	Menorrhagia-Hæmoglobin 65% Ovarian cystoma weighing 15.5 lbs.
119	A.M.	11- 7-27		455.	36	19			17	2	0	25	11	Chronic glandular endometritis
122	M.H.	12- 1-25	7.5		46	23			23	1	1	25	21	Double hydrosalpinx
123	H.L.	2- 4-26	10.		36	24			12	1	3	27	9	Menorrhagia-Hæmoglobin 62%
124	S.R.	6- 5-27	6.5		50	18			32	4	1	33	17	Menorrhagia-Hæmoglobin 46%
125	I.C.	4-10-28	6.5		53	21			32	0	1			Retroversion of uterus
126	M.B.	6- 3-28	9.		43	18			25	6	0	26	17	Menorrhagia-Hæmoglobin 38%
128	K.F.	9- 6-28	7.5		47	25			22	0	0			Double hydrosalpinx—Carcinoma of both ovaries—Syphilis
129	G.M.	10-24-28	7.5		30	24			6	2	0	29	1	Menorrhagia-Hæmoglobin 65%
136	B.B.	7- 8-25	12.5		48	28			20	2	1	32	16	Menorrhagia-Hæmoglobin 64%—Procidentia—Died of peritonitis
137	A.G.	5-21-28	7.5		58	21	48		27	0	0			Squamous cell carcinoma of endometrium
138	M.H.	6-17-28	10.		58	30	52		28	2	1	35	23	Irregular flowing for 6 years past. Calcified myomata
143	E.B.	1-23-24	7.5		50	25			25	4	0	31	19	Procidentia
146	B.M.	12- 3-25	7.5		49	22			27	3	0	29	20	Hysterectomy 8 years after myomectomy—Malignant submucous fibromyoma—Hæmoglobin 25%
Averages for 50 patients					44.36	22.8			20.0	1.4				
Averages for 28 women who had children										2.5				

Access to the tumor was obtained by a transverse incision through the loose vesico-uterine fold of peritoneum with retraction of the bladder. The tumor, which was sessile but not intramural, was removed without weakening of the uterine wall.

On the following day at noon, about an ounce of blood escaped from the vagina, and painful uterine contractions quickly brought the fetus to the perineum, feet first. The fetus, a female about 15 centimeters long, was delivered by traction on the feet. A large sacculated encephalomeningocele was found in the occipital region and a spina bifida extended almost the entire length of the spinal canal without protrusion of membranes. The fetus had the discolored appearance of having been dead for several days.

After some days, the uterus was found to have become retroverted and relaxed. Dilatation of the cervix permitted the escape of several ounces of dark blood. The patient's recovery was then uneventful, and she left the hospital 22 days after the abdominal myomectomy.

The patient became pregnant in November, 1925, and on August 11, 1926, she was delivered at term of a normal female child, weighing 9 pounds and 1 ounce. The baby presented by the vertex in right occipitoposterior position. The head was large and labor was difficult. A low forceps delivery was made by Dr. J. E. Cooper.

In December, 1928, the mother and child were well.

CASE 4. Myomectomy at the fourth month of pregnancy; delivery of a living child at term.

Mrs. E. H. H., 35 years old, had been married for 8 years, and was pregnant for the first time when she entered the hospital, April 20, 1926, incapacitated by a large painful mass in the left lower abdomen. Pain had first appeared 5 weeks earlier, but lasted only 15 minutes and was relieved by sitting down. Pain in the left side had been brought on again by housecleaning activities, and had been severe for 4 days. Since puberty at 13 years of age, the menstrual periods had occurred regularly at intervals of 26 days, and each had lasted 5 days with free flow and without pain. There had been no leucorrhœa, no intermenstrual bleeding, and no hæmorrhages. The last menstrual period began December 27, 1925, but the patient believed that

pregnancy commenced before that date. Vomiting began January 28, 1926, and had not been troublesome. The breasts became tender and heavy about the middle of January.

Examination revealed a loud systolic murmur at the mitral area and at the apex of the heart, but there was no pretibial œdema or other sign of cardiac decompensation. The uterus was found enlarged, corresponding to a 4 months' pregnancy, and a solid tumor larger than a man's fist was found above the left uterine cornu, and could be rotated upward without displacing the cervix. A diagnosis of pedunculated uterine fibromyoma was made, with reservation that the tumor might have its origin from the left ovary. Urine was normal. Hæmoglobin 60 per cent by Dare's hæmoglobinometer, erythrocytes 3,140,000 per cubic millimeter, leucocytes 9,600 per cubic millimeter.

Myomectomy was performed April 21, 1926. The pregnant uterus completely filled the pelvis. There were two small interstitial fibroids which were left undisturbed. A large fibromyoma with attachment to the anterior surface of the uterus in a circular area the size of a silver dollar was found tipped over the left broad ligament, with a tendency to descend behind the uterus. The peritoneum and superficial muscular layer were divided circularly well up on the base of the tumor, and the fibromyoma was peeled out from the uterine wall by sponge dissection, several blood vessels of large size being caught with forceps before being divided. The vessels were ligated, and the wound was closed with sutures of chromic catgut. The uterus was not disturbed from its position, and the fibromyoma was delivered into the wound with almost no rotation of the uterus.

The tumor weighed 14 ounces and contained fully 2 ounces of mucoid liquid content. Microscopically the specimen showed a leiomyofibroma with hyaline change and numerous areas of liquefaction necrosis; chronic œdema; no malignancy (A. S. Warthin).

Morphine was necessary for the relief of pain after operation, but there were no complications, and pregnancy proceeded without interruption.

The patient was delivered by Dr. J. E. Cooper, September 19, 1926, of a normal female child weighing 7 pounds, 10¾ ounces. The fetus presented by the vertex in right occipitoposterior position, and a low forceps delivery was made with rotation of the head anteriorly.

In December, 1928, the patient was in good health and the baby thriving. Menstruation returned 3 months after the birth of the baby, and has been regular and normal until the present time.

CASE 5. Pregnancy and uterine fibromyoma in a woman 40 years old; transverse position of the fetus in labor at term; cæsarean section and supravaginal hysterectomy.

Mrs. M. G., 40 years old, had been married 20 years, had one child 12 years old, and had had no other pregnancies, when she came for examination October 17, 1922. For 10 days she had had pain most of the time in a rounded mass the size of a lemon 2 inches below the umbilicus to the left of the median line of the abdomen.

Menstruation began at 13 years of age, periods recurred at intervals of 21 days, sometimes 28 days, and lasted seldom more than one day. The last menstrual period began June 5, 1922, 4½ months before, and since that date there had been no bleeding, but considerable vaginal discharge for which she had taken a douche daily. Nausea had been present from July 20 to October 1. The diagnosis of fibromyoma and pregnancy was made, and the opinion expressed that the pregnancy could be carried to term. March 6, 1923, at full term, the patient had been in labor 24 hours and the position of the fetus had become transverse, when, after consultation with two obstetricians, cæsarean section was performed and the uterus and tubes were removed by supravaginal hysterectomy. The appendix contained a fæcal concretion and was removed. The uterus contained some small fibroids in addition to the intramural fibromyoma of the anterior wall which had led to the diagnosis. The child, a boy who weighed 6 pounds, 10 ounces at birth, was normal. Postoperative convalescence was uneventful.

Mother and child are well at the present time.

CONCLUSIONS

1. There are manifold relations between fibromyomata of the uterus and pregnancy which concern surgeons and obstetricians.

2. Statistics of sterility caused by fibromyoma of the uterus if they are to be accurate must consider such factors as desire not to have children, widowhood, menopause, and disease of adnexa.

3. Pregnancy and delivery may progress satisfactorily in the presence of a large uterine fibromyoma.

4. Uterine hæmorrhages, breech and transverse positions of the fetus, high fetal mortality, stasis in the urinary and intestinal tracts, and sepsis, are among the important effects of fibromyomata complicating pregnancy, labor, and the puerperium.

5. Diagnosis may involve great difficulty when early pregnancy is present in a fibromyomatous uterus or when a large, soft fibromyoma simulates pregnancy.

6. Myomectomy is often followed by pregnancy in married women less than 40 years of age who are desirous of having children but are sterile on account of fibroids.

7. Patients for myomectomy should be carefully selected, and the right to do hysterectomy should be reserved by the surgeon,

for radical operation may be necessitated by malignancy of tumors, disease of adnexa, or by impossibility of leaving a uterus safe for pregnancy.

8. Myomectomy during pregnancy may be required because of degeneration, torsion, impaction, or the large size of the fibromyomata.

9. Hysterectomy during pregnancy is seldom necessary, and should be done only when myomectomy cannot save the patient from accidents due to the tumor, or when there is infection or malignancy of the tumors.

10. Women who have uterine fibromyomata of large size and have never been pregnant are often sterile for other reasons than the presence of the tumors, as is shown by the findings at operation given in Table V.

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THE HISTOGENESIS OF ADENOMYOSITIS[1]

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ALTHOUGH von Rokitansky in 1860 first described adenomyomata, and in his textbook of pathological anatomy in 1861 reported endometrial cysts of the ovary under the title of cystosarcoma adenoides ovarii uterineum, the subject did not arouse general interest until von Recklinghausen in 1893 and the years following published the results of his investigations. Since that time a huge literature has grown up about the subject of adenomyositis, adenomyosis, or endometriosis, but the histogenesis of these peculiar growth formations has remained controversial. In fact today, following the brilliant work of Sampson, it is perhaps more in dispute than before.

Sampson's well known theories have stirred up the whole subject so fundamentally that a tidal wave of endometriosis has swept through the medical journals during the last few years. As always in such instances, the followers of the propounder of a faith have gone farther than the master himself and threaten by their uncritical enthusiasm to discredit the painstaking and laborious efforts of the original worker. Any ovarian cyst or tumor filled with old blood is called a chocolate cyst, implying that it belongs to the category so designated by Sampson. Any area containing glands surrounded by an endometrial stroma-like tissue or even without the latter is labeled "endometriosis." I feel that many of these cases, especially those lacking the cytogenic stroma, are not endometriomata at all. Some, for instance, may be nothing but serous peritoneal cysts surrounded by an inflammatory reaction; others, normally occurring embryonal tubules (epoophoron and paroophoron). These pseudo-endometrial tumors are often hard to explain, were they really endometriosis, so that as a result they tend to cloud still further the histogenesis of adenomyositis. While we must admit that, theoretically at least, adenomyositis may occur in any area of the abdominal cavity, the matter becomes ludicrous when a few irregular and penetrating glands surrounded by lymphoid tissue in a tonsil, for instance, are called endometriosis. We know that even in the male inflammation may produce irregular gland structures, and Friedlander has seen such pictures in granulation tissue; Lubarsch in the stomach; Orth and Richter in the intestine; and Aschoff in the gall bladder.

As an example of pseudo-endometriosis, I show Figure 1. Here cervical glands are surrounded by what at first may appear to be an endometrial stroma, but is in reality only a marked hyperplasia of small round cells and of the lymphoid follicles, frequently found to a lesser extent in this region. Perhaps I am peculiarly qualified to pass on this picture, since some years ago I painstakingly investigated these small lymph follicles in both the endometrium and cervix, cutting thousands of sections from hundreds of specimens (96). We must remember that aside from such more or less superficial morphological resemblances, even morphological identity cannot be considered a proof of the derivation of the tissue, as Robert Meyer pointed out years ago. Cytogenic stroma surrounding glands does not mean that the tissue must be of muellerian origin, since we know that the epithelial growth influences the stroma underlying and surrounding it. Robert Meyer believes that the stroma grows first, and Lahm has recently expressed the same opinion. Benecke and Fischel, however, believe that the connective tissue growth follows the glandular growth. Which is primary and which is secondary is not of great importance to us here, since all the various investigators agree to the fact that the epithelial growth molds the character of its stroma. Instead of placing so much weight, therefore, on a purely formal relationship, we should rather stress the functional identity of tissues, as Robinson has recently emphasized again. We must, however, be careful as to what we interpret as evidence of functional identity. Cullen, who has from the

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beginning always held fast to the muellerian origin of the endometrium-like growths, has interpreted bleeding, and especially periodical bleeding, as proof of the muellerian origin of such growths, and Sampson has expressed similar views. Such an assumption is, however, hardly tenable. One has but to think of supplementary and vicarious menstruation from tissues which surely have nothing to do genetically with endometrium (gums, nasal mucosa, gastric or intestinal mucosa, and so on). Again, von Franqué has described a cyst of the wolffian duct with tarry blood contents, and several years ago I operated upon 2 cases, evidently also of wolffian duct origin, which likewise contained old blood, but showed none of the characteristics of adenomyositis.

In the first case, M A., a woman of 45 years, had a cystic mass about the size of a large lemon, between the left labium majorum and minorum. The exact original location was hard to determine because of the size of the mass. I believed it to be a cyst of the Bartholin's duct or gland. The history of the case was that the tumor had enlarged gradually during 5 years, and occasionally, about the time of the menstrual period, became painful. At other times its large size was bothersome. After removal, the cyst was found to be filled with dark tarry blood, and was lined with columnar epithelium with here and there areas of ciliated cells.

I do not believe that we can do anything but attribute the cyst to the wolffian duct from which so many of the usual simple cysts in the lower vagina and hymen originate. The tarry contents of the cyst are interesting, especially in view of the pains about the menstrual periods. One could, of course, give other derivations for this growth, but the complete absence of endometrium-like glands and cytogenic stroma would be hard to reconcile with this picture, in view of what has just been said regarding the influence of glandular structures on the surrounding stroma. I will take this up in detail later on, and also touch upon the question of the presence or absence of hæmorrhage in different cases. It must, however, be stated immediately that hæmorrhage into a cystic hollow space of the body is almost a natural occurrence (cases of Frankl, Schickele, Nebesky, Lichtenstern, and others), and only shows at most that the tissue in question has a certain tendency to take part in the cyclic menstrual changes of the genital apparatus.

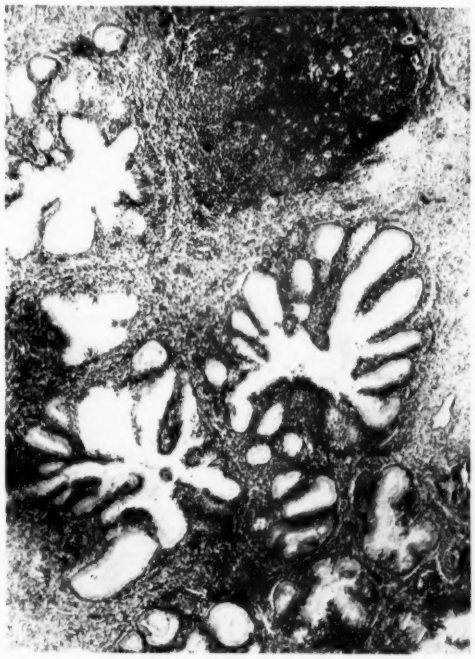

Fig. 1. Section of cervix originally diagnosed as adenomyositis of cervix by a pathologist. It represents, however, only a cervicitis with hyperplasia of the lymph follicles found not infrequently normally in this area. Above in the picture a large lymph follicle with germinal centers. A small lymph node is seen below the large gland to the right of the picture. Photomicrograph of a slide in the author's collection.

The second case, Mrs. E. B., was a woman of 32 years, on whom a panhysterectomy with removal of the tubes and ovaries was done because of menorrhagia. The uterus was fibromyomatous, and chronic salpingitis and numerous follicular cysts of the ovary were also present. Macroscopically nothing of importance was to be seen in any of these organs. A flap of vaginal wall, however, showed five small cysts up to 1 centimeter in diameter on the vaginal side of the flap. These cysts were filled with tarry blood. The cysts ran downward from the cervix in a straight line and were off to one side of the median line. They reminded one very much of the pearl-string arrangement of cysts of the wolffian duct seen not infrequently in cows and pigs. Microscopical examination of numerous sections showed cysts lined with columnar epithelium. The epithelium was not preserved well enough to state definitely its type, although I thought I saw cilia at

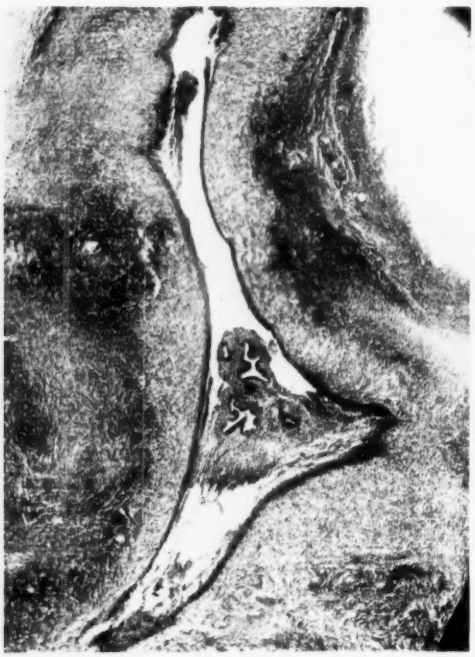

Fig. 2a.

Fig. 2b.

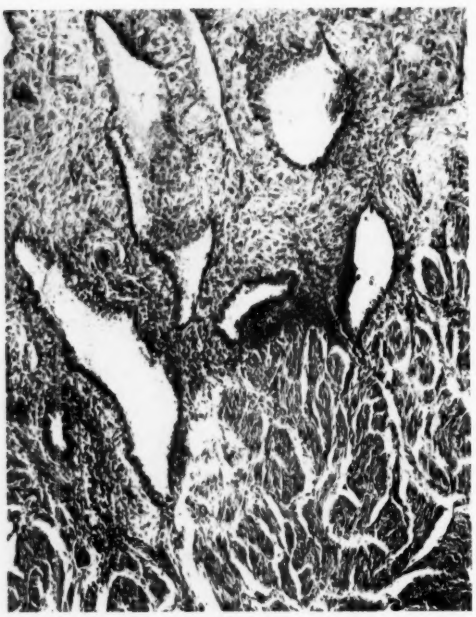

Fig. 3.

Fig. 2. a, Cavity deep in the tissues of an ovary which was removed together with a fibromyomatous uterus and the rest of the adnexa. No signs of adenomyositis in any of the other organs. The cavity was surrounded by musculofibrous tissue and shows indications of a definite wall of its own. In the cavity is typical endometrium. Author's collection. b. Higher power of endometrium of a.

Fig. 3. Definite adenomyoma from between the folds of the broad ligament removed during a cæsarean section. In the lower part of the picture is fibromuscular tissue, then dilated glands of the basalis, and above a marked decidual reaction. Author's collection.

one point. Remnants of blood were present. The cysts lay under the stratified squamous epithelium of the vagina, and were separated from it by a thin layer of musculofibrous tissue. A connection between vaginal mucosa and cysts could not be seen. Evidences of injury to the vaginal wall were not present. The posterior surface of the vaginal flap, the cervix, and the rest of the removed organs were entirely devoid of any similar cysts or evidence of adenomyositis.

I think that in this case, where again we see hæmorrhage, we can also, from the location and structure, safely assume an origin from the wolffian duct tissue.

I cite these cases which, except for their blood contents, were simple wolffian duct

Fig. 4. Squamous cell or at least transitional cell nodules from the serosal surface of a fallopian tube in a case of curettage for endometrial hyperplasia and suspension of the uterus. The tubes were resected because the pictured nodule simulated tuberculosis. Unfortunately, the best slides were lost, the nodule on the right is folded up and the larger one on the left has some of the tissues of the musculo-fibrous wall of the tube pulled over it. These are artefacts as the nodules were directly continuous with the serosa of the tube. Author's collection.

cysts solely as an illustration of the difficulties encountered in choosing a criterion which represents a safe determinant for the derivation of a given tissue in a histological picture.

Since the morphology of adenomyositis or adenomyosis, or endometriosis has been so frequently and so minutely described, I will abstain from any detailed description of these lesions and limit myself to a consideration of the various theories which have been propounded to explain them. We can classify them under the following headings:

1. Embryonally misplaced tissue—(a) wolffian, (b) muellerian;
2. Postnatally displaced tissue;
3. Direct invasion from the endometrium or endosalpinx;
4. Derivation from the peritoneum (serosal theory of Iwanoff and Meyer);
5. Metaplasia of lymph vessels and spaces;
6. Metastatic transplantation through the vessels, especially the lymph vessels (Halban);
7. Transtubal implantation (Sampson).

Each one of these hypotheses has its adherents. Some men recognize all or nearly all of them. Others again pin their faith to only one theory, at times even to the point of blinding themselves to the facts which clearly make the particular concept improbable.

The earliest theory, that of von Recklinghausen, considered adenomyomata to be derived from the wolffian body, and Babes, Pick, Hartz, Pfannenstiel, Chiari, Schickele, Nebesky, Babo, Vassner, Neumann, Robert Meyer, at first, and others, Lockyer even as late as 1918, supported this view. Robert Meyer and Klein, however, soon showed that the wolffian body never descended farther than to about the insertion of the round ligament into the cornu of the uterus, so that below this point adenomyomata were henceforth attributed to changes in the wolffian duct. It is true Nagel claimed that the wolffian duct did not descend below the cervix, but this was disproved by others (Klein, Dohrn, Van Ackeren), and the wolffian theory remained in force.

Some time later, however, von Franqué succeeded in tracing out the direct connection between the endosalpinx and the so-called wolffian remnants in cases of salpingitis isthmica nodosa, and although some authors regarded these lesions as true tumors (Aschoff, Brunet, Pick, Meyer, Schickele, Wolff) and Maresch thought that they arose from preformed tubal diverticula (see also Lahm) Schauta, Kehrer, Wallert and Hoehne soon agreed with von Franqué in considering

Fig. 5. Longitudinal section of a tube showing the outgrowth of the endosalpinx around the fimbriated end onto the serosa. The tubes had originally been implanted into the vagina through a slit in the posterior vault for the purpose of temporary sterilization, because the patient suffered from pulmonary tuberculosis. Two years later the tubes, which were thickened and tender, were removed. Case originally described by A. Mayer (92). Author's collection.

Fig. 6. Cross-section of tube described in Figure 5.

Fig. 7. Endometrial fragment of the interval phase in the lumen of a fallopian tube. Slide seen by author; photograph by courtesy of Dr. Louise Meeker, of the New York Post-Graduate Medical School and Hospital.

salpingitis isthmica nodosa as inflammatory. Furthermore, it was shown, since Waldeyer in 1870 first described downgrowths of germinal epithelium in the human ovary, that the medullary rays of the ovary, supposedly of mesonephric origin and considered the starting point of ovarian adenomyoma, were really only invaginations of the surface epithelium, and later the pigment sometimes seen in these "wolffian remnants" and accepted as being the same as that of Giralde's organ, was found by Cohen to be ferruginous (probably blood pigment), whereas the pigment of Giralde's organ is iron-free. Aside from these points, however, we see that those tumors which we know to be of nesonephric or wolffian origin—paroophoron and epoophoron cysts—do not show the structure of adenomyomata. Nor do the wolffian remnants seen often in the ovary exhibit any special tendency to grow, and the base of the bladder, definitely of wolffian origin, although it may show marked metaplasia, has not, so far as is known up to the present time, produced a primary adenomyositic growth. Lastly, it must be admitted that from their very location alone wolffian remnants could explain but a small percentage of the occurring adenomyomata. In view of these facts the wolffian origin of adenomyomata has been dropped by most men, and I believe justly so. There is no real evidence for it, and much against it.

The second possible source of misplaced embryonal tissue is the muellerian system, and while there is proof enough that most of the cases of adenomyositis in the uterus are due to the direct extension from the endometrium, embryonally misplaced muellerian tissue as a point of origin for adenomyomata has been more or less discredited of late, and I believe not justifiably so. In fact, Cullen, Lockstaedt, Kossmann, Lichtenstern, Russell, and others have always advocated the muellerian origin of adenomyomata, wherever situated, in contrast to the wolffian theory of the other investigators mentioned above.

When we consider that there is hardly a tissue or organ in the body of which instances of heterotopic growth have not been recorded, it would be strange indeed if muellerian tissue were not at times displaced. Muellerian tissue has the peculiar ability of reacting in a special way to the ovary, so that even on the basis of pure logic, displaced muellerian tissue must at times be the source of adenomyositic growths. In addition, there is phylogenetically good cause to assume that in the ovary, for instance, muellerian tissue may occur. In the salamander ater the fallopian tube directly enters the ovary, and even in so high a vertebrate as the otter, the muellerian duct as a continuation of the fimbria ovarica reaches the hilus of the ovary (Kocks). Hartmann, in a recent contribution on the opossum, showed dystopic fimbriæ growing on the surface of the ovary as far as 90 degrees from the normal fimbriæ, and in 1926 Novak described a similar previous case of Hartmann. More important still is the fact that the location of some adenomyomata allow of no other explanation than that of misplaced embryonal remnants. The following cases I believe have their origin in such embryonal misplacements:

The first case, S.G., was a young girl of 22 years, who ever since she started to menstruate had increasing pain on her left side. Examination revealed a cystic tender mass, the size of a grapefruit. At operation this was shown to be attached to the left cornu of the uterus. It contained a large amount of dark tarry blood. The histological picture was that of a typical adenomyoma. In view of the youth of the patient, the large size of the tumor, and the history of left-sided pain since her first menstruation, I think we must accept this case as a congenital anomaly, perhaps even as a rudimentary uterine horn.

Two other cases seen by me some years ago may also have been due to embryonally misplaced muellerian epithelium, since in both cases deep in the tissues of a uterine fibromyomata there was an adenocarcinomyoma, while the endometrium of the uterus was normal. In the literature similar cases have been described by Robert Meyer, Babesiu, von Recklinghausen, and Rolly.

The next case, J.P., was a woman operated upon for a fibromyomatous uterus in whom the ovary (Fig. 2, *a* and *b*) was slightly enlarged, contained some follicular cysts, was otherwise grossly normal, but on microscopic examination showed a typical adenomyoma. Although no serial sections were made, very many sections were taken from different parts of the ovary, and nowhere was there any evidence of an endometrium-like tumor penetrating

from the surface of the ovary to be seen. A van Giesen stain showed abundant muscular tissue surrounding the endometrium.

Although a few muscle fibers seem at times to be produced locally in reaction to a glandular growth along with a cytogenic stroma, abundant musculature can only be explained by misplaced muellerian tissue, even wolffian structures never showing a great amount of such tissue.

The last case (Fig. 3) was a young woman never previously operated upon from whom, at the time of a cæsarean section, a tumor the size of an egg was enucleated from between the folds of the broad ligament. The serosa was not involved here. Microscopically the tumor was made up of abundant muscle tissue covered with a thick layer of decidua and a few endometrial glands just above the surface of the muscle layer. Here again I believe only an embryonal misplacement can explain the lesion.

In the vagina also embryonal remnants either in the form of glands or islands of columnar epithelium have been offered in explanation of the adenomyomata or primary adenocarcinomata of the vagina (Robert Meyer, Pick, Kleinhaus, Bail, Hoehne, and others). In view of the notorious instability of the line of demarcation between squamous cell epithelium and columnar epithelium around the region of the external cervical os, and the fact that cylindrical epithelium has a tendency to form glands by invagination from the surface, such an assumption is not at all far fetched, as shown for instance by the papillary form of cervical erosion produced by the downgrowth of the cervical columnar epithelium. We must also remember that in early fetal life the vagina is lined with columnar epithelium, which, according to Robert Meyer, even has small glands.

While we must therefore admit that some cases of adenomyositis evidently develop from embryonally misplaced muellerian tissue, such an assumption will satisfy all requirements in but a few of the so frequent cases of adenomyositis. For this reason it was thought that postnatally displaced muellerian tissue might also give rise to heterotopic growth in some instances.

Endometrium, for example, might be transplanted traumatically or by tumor growth deep into the myometrium and grow there. Inflammation or irritation might cause postnatal epithelial displacements and invaginations with or without metaplasia (Robert Meyer). Even the basalis of the squamous cell epithelium was considered capable of producing adenomyositis and small cystic formations of the vagina were attributed in some cases to such a change (Sitzenfrey and others). This would, however, represent only a form of adenomyositis produced by direct invasion of the surrounding structures by muellerian tissue with accompanying metaplasia. That such a process is the most usual mode in the production of adenomyositic growths of the myometrium and that metaplasia of the muellerian epithelium is not rare must be admitted without question. As far as the production of adenomyositis by the growth of misplaced endometrium is concerned, we see that this concept represents but a forerunner of Sampson's theories, and since it will be taken up together with these, I will not go into the subject now. It is interesting to note that the misplaced epithelium has for years generally been conceded the power to grow.

Even postnatal misplacement, however, did not seem a sufficient basis for many adenomyomata, and it was Iwanoff and then especially Robert Meyer (also Opitz, Sames, Heine, von Rosthorn, Schottlaender, Amann, and others) who showed that the serosa of the abdominal cavity was capable of transformation and would form invaginations, especially on the basis of an inflammatory reaction, but also without it. Other authors (Lauche, Dietrich, and so on) held similar views and the theory certainly is plausible enough, since the cœlom is to be considered the progenitor of the muellerian tissue, and the germinal epithelium is really but changed serosa. Likewise the serosa shows changes in response to ovarian function, areas of cuboidal and even ciliated epithelium, and at times decidual reaction even as high up as the under surface of the liver having been described (Schmorl, Lahm, A. Mayer, Pfannenstiel, Robert Meyer, Fabricius, Pick). That the presence of cytogenic stroma offers no obstacles to such a theory has already been discussed. Figure 4 shows that even stratified or at least transitional epithelium may occur in the peri-

toneum. The case was one of curettage and suspension of the uterus. On the tubes were little miliary whitish nodules which appeared to be tubercles. The tubes were therefore resected. The uterus was normal. The curettings on examination showed only a moderate hyperplasia of the endometrium, and the nodules on the tubes proved to be made up of the epithelial masses described which were on the surface of the tube, and apparently continuous with the serosa. Unfortunately, my best sections were lost in transit, so that the present picture is not so good as it might be, but it does show the character of the epithelium. It is interesting in this connection that Osler, in his *Textbook of Medicine*, states that primary carcinoma of the peritoneum is frequently of squamous cell type. Another instance of modification of the serosal surface of the tubes is shown in the next two pictures (Figs. 5 and 6), of a case originally reported by A. Mayer. The fallopian tubes in this case had been transplanted into the vagina through a slit in the posterior fold for the purpose of temporary sterilization. The tubes were removed later because they were thickened and tender. They showed that in response to the irritation the whole tubal mucosa had grown out upon the serosa. That this is not a freak reaction is proved by a similar case reported by Neu. Here the tubes had become prolapsed into the vagina following vaginal hysterectomy.

The serosal or cœlomic histogenesis of adenomyositis has much in its favor, and the pictures produced by the invagination of the serosa, with or without accompanying cytogenic stroma, have been described so often that it will suffice here to point out that with the cœlomic theory all extra-uterine and many uterine cases of adenomyositis can be explained, with the exception of a few such cases as have been described and pictured before. Indeed, in the light of our present knowledge the cœlomic theory is the only plausible one for some types of adenomyositis. Thus the cases of adenomyositis of the umbilicus (Cullen, Lauche, Tholber and others) can be easily explained by the evagination by the yolk stalk, allantois and umbilical vessels of a small piece of cœlom which later becomes embedded in the abdominal wall, whereas no other theory will do the same. Despite this Cullen, Goddard, Waegeler, and others consider umbilical adenomyomata to be derived from the genital tract although they can offer no explanation of their mode of origin.

The objection of O. Schwarz, that the serosa cannot be the source of adenomyositis because the tubes and cervix which are even more closely related to the endometrium than the cœlom seldom show adenomyositic change, is not tenable. These organs have been differentiated into tissues which normally do not react to the causes producing endometrial growth and endometrial changes. In fact tube and cervix react less to the ovarian influence than the serosa, and this is understandable if we consider that the serosa is less fully differentiated, more unripe, as it were, and thus more or less virgin soil as far as growth potentialities go.

Another point of origin for adenomyomatous growth is supposed to be the endothelium of the vessels, especially lymph vessels and spaces (Sitzenfrey, Schottlaender, Opitz). It is certainly not infrequent to find the endothelium of the lymph vessels assume a cuboidal shape, as described by Brunet, Kroemer, Pankow, Scheib, Sitzenfrey, and others, and when such vessels become irregularly surrounded by a lymphoid stroma or an inflammatory area, a picture of adenomyositis may perhaps be simulated. I have, however, never seen pictures of this type, which did more than simply resemble adenomyositis and the functional activity in the sense of the monthly cycle has never been reported. The same is true of the glandular structures seen at times in the lymph glands of the pelvis. Such structures were first regarded as metastases of a carcinoma, but a more thorough investigation showed that these gland-like areas also occurred in simple inflammation (Robert Meyer, Falkner) in various parts of the body. Therefore, the idea that these "glands" were carcinoma metastases (Wertheim, Ries) or parts of the wolffian body (Wulfing) or had any connection with adenomyositis, had to be given up. I think that no one today seriously believes that adenomyomata are direct trans-

formations from lymph vessels. To me at least such a belief is impossible because of the great genetic differences between lymph vessels and muellerian tissue in its widest sense. Furthermore since lymph vessels are present throughout the body, it would be hard indeed with such a theory to explain why adenomyositis is not found in every or any location of the body.

The metastatic theory of Halban, that is, the transportation of endometrial fragments by the lymph vessels, must be evaluated a little differently. It has just been pointed out that metaplasia of lymph vessels and inflammation in lymph glands may produce histological pictures simulating adenomyositis so that great care must be used in interpreting endometrium-like areas in the lymphatics as actually being muellerian tissue. At the same time, it must be granted that pieces of endometrial tissue may perhaps at times be transported and then may be found in a vessel or space of a laboratory section, since we know, for instance, that chorionic villi are carried away sometimes by the body vessels, although such chorionic villi never grow except in cases of malignancy. Nevertheless, considering the difference in character of the placental implantation and the nonpregnant endometrium, metastatic transports from the latter must be exceedingly rare. Were such a mode of transportation a real possibility in the production of endometriosis, we should again expect adenomyositis to occur in any part of the body, but this is not so, and we cannot say that endometrium, if far removed from the ovary, will not grow, since Sochet, at the October meeting of the New York Obstetrical Society, reported the successful implantation of endometrium from the uterus of a guinea pig into the anterior chamber of its eye. I myself, however, have seen some cases in which endometrium appeared to be in the lymph spaces, but close examination has always shown that the invasion of the lymph vessel was from without. If fragments of endometrium really are found in the lumen of the vessels, perhaps following trauma, I believe that such endometrium is either degenerating, or has reached its site artificially, since extensive adenomyositis in the lymph vessels or spaces has never been seen. Very probably also some of the described cases of endometriosis in the lymph vessels represent but the inflammatory changes mentioned above which have nothing to do with true endometriosis.

The last theory we have to consider is Sampson's hypothesis of transplantation which has aroused so very much discussion. Sampson's theory really consists of two separate entities: one, the traumatic implantation of tissue into various locations, especially the abdominal wall, following laparotomy; the other, the transtubal implantation of endometrium into the peritoneum. We have already seen that for years the possibility of traumatic implantation has been accepted for certain rare cases. Sampson has only built up this side of the question more than had been done before. Sampson has dwelt especially upon the question of implantations of endometrium into the abdominal wound. Adenomyositis of the abdomen following laparotomy has been reported by Robert Meyer, von Franqué, and Klages years ago, and later also by Fraas and Lauche, but was always considered to be due to modified peritoneal serosa which had become embedded in the abdominal wound. We must bear in mind that cases of abdominal wound endometriosis are very rare in proportion to the large number of women laparotomized every day (Heaney, Danforth, and Hosoi and Meeker). Were Sampson's view in this matter correct, we should, however, expect such implantation of endometrium into a laparotomy wound quite frequently. Another objection to Sampson's concept is the fact that abdominal wall endometriosis has been reported in patients in whom the uterus and tubes were not incised at all. Pankow's well known case of a girl of 5 who was operated upon for appendicitis and long after puberty developed an adenomyositis of the abdominal wall is an especially strong point against the transplantation hypothesis. Furthermore, if, as reported, abdominal wall endometriosis following cæsarean section is due to implantation, why is it that there is not a clearly recognizable clinical association between ectopic pregnancy and endometriosis? Personally I believe the serosal derivation of such growths

to be a more logical explanation. At the same time, it cannot be absolutely denied that growth of implanted endometrium does not occur in some few cases, since experimentally misplaced endometrium not infrequently will grow. Stilling saw growth of endometrium transplanted into the spleen; Sochet, as mentioned, in the eye; Jacobson, Hunter, Cron and Gey, O'Keefe and Crossen, Katz and Szenes, all grew endometrium transplanted mostly on to the peritoneum. This last type of experiment is little conclusive to me, however, since there is no proof that the endometrium grew and that it was not the serosa which reacted by reason of the stimulation caused by the transplant. Heim, however, at the University of Tuebingen, has succeeded in growing endometrium in tissue culture. We cannot, therefore, deny the possibility of transplants growing but this concept is certainly not necessary, as the serosal theory will explain the lesions equally well and explain them all, which the implantation theory will not do.

As far as Sampson's transtubal transportation of either endometrium or irritating menstrual blood is concerned, it does not appear logical to me. Since the objections to this transtubal concept of Sampson have been summarized by Novak and are practically the same as the ones I laid stress upon in various discussions of the subject (New York Pathological Society and New York Academy of Medicine), I do not have to go over this whole field here, but can limit myself to just a few points which seem to make transtubal implantation as a mode of disseminating endometrium at least improbable. First of all, Sampson's few cases do not alter the fact that practically never does menstrual blood exude from the fallopian tubes (squeezing or stripping the menstrually congested tubes, of course, being no fair test). Again, the tubal lumen, although it may at times be considered to be large enough to allow pieces of endometrium to pass through it, is generally far too small for transportation of the fragments of endometrium which have been found in the tubal lumen. It is impossible, even if we admit of tubal antiperistalsis, to conceive that this latter would be so systematic as to push through a large piece of endometrium, especially in view of the recent investigations of Dryoff and Hermstein on tubal contractions, of Kok on antiperistalsis in the tubes, and of Novak on the strength and persistence of the fimbrial current. The endometrium in the few cases in which it has been seen in the tubal lumen so far has always been of the interval phase, and of the type shown in Figure 7, and so could only have been dislocated traumatically. The possibility of such endometrium ever reaching the peritoneum even if it were really viable and going up the tube, would be very small, since the dislocated fragment would probably be caught in the tubal folds, and endosalpingeal endometriosis should then occur more frequently than peritoneal implantations. Such, however, is not the case. The explanation offered for this discrepancy is that the tube is not suitable soil. This, as has been stated, holds good so far as the direct transformation of the tubal structures into adenomyositic lesions is concerned but would not be tenable for cases of simple implantation. Furthermore, that the tube can and does at times react, is shown by the not infrequent occurrence of salpingitis isthmica nodosa, and by Figures 5 and 6. Again, although carcinoma cells have been found in the tubal lumen with primary carcinoma of the uterus (Schiller, von Franqué and others) Novak has shown that metastases to the ovaries from the uterine cavity are rare, and when they do occur, are more easily explained by the lymphatic route. Also, if implantation were a mode of spreading endometrial growths, would it not be more logical to expect implants and a reaction to menstrual blood at least once in a while in the cervical canal, instead of assuming that the menstrual current reverses itself and flows up into the abdomen, carrying along bits of menstrual mucosa? Even if we supposed that the endometrium bathed in the lytic menstrual fluid is viable, the retrograde transport through the tube must take longer than the tissue possibly can retain its viability. Although endometrium traumatically misplaced has been grown at times, menstrual endometrium has always failed to grow except when the basalis was scraped off with it. This is true also of Heim's

tissue culture experiments. The only observers who claim they grew menstrually desquamated epithelium were Cron and Gey, and since thus far they have not stated their methods or given any details, the acceptance of this fact, contrary to the opinions of all other observers, must be looked upon at least with much reserve. Furthermore, as Novak has pointed out, at the time of menstruation there is no portal of entry in the ovary for the endometrium arriving through the tubes. Again, such misplaced endometrium as has been seen in the tubes was in every instance from the upper layers of the endometrium, and this probably has little power to grow, the basalis alone being invested with active growth potentialities.

It has also been suggested by Sampson that the menstrual blood itself passing through the tubes may set up irritation and changes in the peritoneum. Years ago Taussig made a similar suggestion. However, menstrual blood is both lytic and toxic (Frankl, Macht and Lubin, Schick), and blood, when it is found in the peritoneum, does not have to come from the tubes, since the ovaries also offer a possible source of the hæmorrhage (ruptured follicles, corpus luteum bleeding, and so on) as Spencer and Novak have emphasized. Besides, if menstrual blood has the irritating and growth producing tendencies claimed for it by Taussig and Sampson, why does it not cause occlusion of the tube, or at least a proliferation of the endosalpinx, as seen in Figures 5 and 6? The fact that the tubes are usually open, which Sampson considers strong evidence for his theory, is to me even greater evidence against it. That Hartmann has found dystopic fimbriæ on the ovary of the opossum, an animal which does not menstruate, must also be remembered.

The fact that in most cases the ovaries are adherent I think also suggests peritoneal irritation as the preliminary feature because the small amount and the histological picture of the endometrial tissue frequently seen in the ovaries certainly make it unlikely that such a process should have caused the adhesions. To me it seems more likely that a small ovarian hæmorrhage, for instance from a corpus luteum, occurred, and that this then produced adhesions, irritation, and secondary serosal proliferation.

As a final evaluation, the theory of transtubal transportation of endometrium seems to me more unnecessary than any other hypothesis. To explain the various lesions of adenomyositis as being the result of serosal changes offers no difficulties but to explain them by transtubal transportation means that we have to accept for granted several factors, each one of which is at least uncommon and even empirically improbable.

I want to touch on one last point, namely, that of the presence or absence of hæmorrhage, i.e., menstruation, in adenomyositic lesions. Sampson believes that this difference in reaction is due to age and the time of the menstrual cycle at which the endometrium is transplanted. This seems an inadequate explanation since endometrium viable enough to grow after transplantation must be able to react to the corpus luteum hormone, no matter at which time of the monthly cycle it was transplanted. Novak likewise does not believe in Sampson's explanation and claims that the reason that some adenomyositic growths do not menstruate is due to the fact that they are made up entirely of the basalis endometrii, which does not menstruate. He cites similar non-cyclic hyperplasia of the uterus and also the behavior of endometrial polyps some of which pass through the menstrual cycle, while others do not. Novak believes the latter to be polyps of the basalis pushed to the surface. I must admit I cannot follow Novak here at all. Since after every menstruation only the basalis is left, every endometrium represents a growth of the basalis, non-cyclic hyperplasias are due to an increased follicular activity without sufficient corpus luteum hormone. Hammond has shown in the ferret, which ovulates only on coitus, that the same hyperplastic endometrium will be carried throughout the whole heat of the animal if coitus, that is ovulation and the formation of a corpus luteum, is prevented. If endometrial polyps do not share in the cyclic changes of the rest of the endometrium, it is not because they are made up of the basalis but because, being pedunculated, they do not receive a sufficient amount

of blood; that is, in this case, a sufficient amount of the corpus luteum hormone carried by the blood, to react. The objection that these polyps could not develop and show hyperplasia, if this were true, is not valid because the follicular hormone reaching them, even if small in amount each month, would have a cumulative action, whereas the corpus luteum action must be sufficient at one period to produce the menstrual changes and cannot in the nature of things become cumulative.

If we were to accept Sampson's theory of endometrial transplantation it would be difficult to understand why adult endometrium should not always menstruate, as indeed the endometrium penetrating the uterine wall by direct invasion usually does. If it does not it may again be due to insufficient blood supply. If, however, we adopt the serosal theory, the explanation of the hæmorrhage or menstruation being present in one case and not in another is to me at least very easy. It simply depends on whether or not the follicular hormone has sufficiently differentiated the serosa (or the embryonal rests) to allow them to function. It would lead too far to go into a more detailed discussion of this question here, and the subject will be more fully taken up in a subsequent paper.

A word regarding the nomenclature of these peculiar lesions may not be amiss. They were first called adenomyomata, but we soon learned that most cases were not true tumors. Robert Meyer then called the process adenomyositis because he thought it arose on the basis of inflammation, and inflammation in some cases indeed tends to be an inciting factor, as some of the illustrations shown seem to indicate. I do not believe that the inflammation *per se* is the deciding factor, and in many cases no signs of inflammation are present, so that Frankl suggested the term adenomyosis instead of adenomyositis. To designate these lesions adenomyosis, however, in view of the fact that the term adenomyositis is the older term and so much better known carries the implication that one rejects altogether the inflammatory reaction as a contributory cause. Again, endometriosis or muellerianosis seems to indicate that the structures are definitely of endometrial origin. It was for this reason that, after debating the question with myself, I finally decided to use the old familiar designation adenomyositis, although I was well aware of the inaccuracy of this terminology.

CONCLUSIONS

Considering all the various points discussed, it seems to me that aside from the direct invasion of tissues by the endometrium or endosalpinx, the serosal origin of adenomyositic lesions is to be accepted for most cases. In some rare instances (depending on the location and the amount of muscle tissue present), I believe that it is necessary to assume misplaced embryonal remnants of the muellerian system to be the origin. That transplanted endometrial tissue may at times produce endometriosis cannot be directly denied, but such cases are probably rare. Furthermore, this last source of origin is not necessary to explain the hitherto reported cases of adenomyositis.

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URETERO-URETERAL ANASTOMOSIS

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SCHOPF in 1887 made the first attempt to unite a divided ureter in man. After severing a ureter in removing an intraligamentous cyst, he joined the ends with eight silk sutures through all layers except the lining. The patient recovered from the operation but died 7 weeks later of tuberculosis. At the postmortem examination the ureter was found firmly embedded in scar tissue. Tuffier was unsuccessful in his attempts to perform the operation in dogs in most instances because of peritonitis, and in the others because of ultimate stenosis of the ureter.

From this early work it was apparent that urine escaping at the site of the suture caused marked scar tissue formation and that the contraction of the scar tissue produced stenosis of the ureter. To avoid leakage of urine, invagination of one end in the other was attempted by such procedures as the end-in-side method of Van Hook and the end-in-end method of Pozzi. To circumvent narrowing of the ureter due to contraction in a circular scar Bovée advocated the oblique anastomosis. Judging from reports made after observation of animals for a relatively short time after the operation, the results were good with most of the methods used.

Meanwhile, reports of uretero-ureteral anastomosis in man were published. Judged by the continued good health of the patient following the repair, many of these operations were considered successful. Frederick, in 1901, reported a patient entirely well 5 years after union of a divided ureter, but in 1910 at the postmortem examination he found stenosis of the ureter and marked hydro-uretero-nephrosis. Obviously, even with long-continued absence of symptoms, there still may be loss of function of the affected ureter and kidney. In 72 reports of ureteral repair collected by Peterson in 1920, postoperative examination with the cystoscope was recorded by McMonagle, Lavise, and Perlis, with the cystoscope and sounds by Bovée, Forsell, Pozzi, and Kayser, and by segregation of the urine from the two ureters by Davis, Fournier, and Reed. But these examinations, the only ones recorded in the 72 reports and made, as a rule, soon after the operation, gave no information as to the presence or absence of dilatation of the ureter or renal pelvis and so were of little aid in judging the final results of the operations.

From considerable experimental evidence Alksne concluded in 1909 that every ureteral repair was followed by stenosis due to traumatic œdema and that atony of the ureter with loss of the normal peristalsis resulted in hydro-ureter in all instances and hydronephrosis in most. Gouverneur, after making experimental observations, and studying the reports of ureteral repair in man, decided that the best procedure in handling the cut ureter is uretero-cystoneostomy, but that if the location of the cut makes this maneuver impossible, end-to-end suture should be done. He stated that simple end-to-end suture is preferable to the "useless traumatism" of the Pozzi method of invagination. He believed a watertight non-narrowing repair absolutely necessary, and agreed with Alksne that the "interruption by section of the musculonervous tunic" seriously interferes with the normal excretion of urine. In all his animals, as in those of Alksne, even with minimal cicatricial stenosis, there was dilatation of the ureter at the end of 2 months. In spite of the poor late results, he believed that the repair should be attempted, because gradual loss of function of the affected kidney, even though finally complete, is preferable to sudden total suppression of function either by ligation of the ureter or by nephrectomy.

Bouchard and Laquiere reported an operation on a woman 19 years after a ureteroureteral anastomosis had been done. A marked hydronephrosis was found with the ureter dilated to the size of a finger and the kidney

parenchyma markedly atrophied, and there was an epithelioma at the lower pole of the kidney of sufficient size to displace the dilated ureter medially. The dilatation of the ureter they considered due to interference with the normal peristalsis, as the lumen was still patent. Because of the questionable results of ureteral anastomosis and the added time required for ureteral repair many surgeons, including Floris and Miginiac have ligated the proximal end of the severed ureter.

Bovée concluded, in 1896, that ureteroureteral anastomosis was preferable to nephrectomy or ligation of the ureter. Peterson believed this conclusion substantiated by time and investigation and thought that the operation might be permanently successful. Seven months after making a ureteral anastomosis he found the repaired ureter patent, but in the pyelo-ureterogram there was definite dilation of the ureter and renal pelvis with a minor degree of involvement of the terminal calyces. Gouverneur interpreted the dilation of the renal pelvis in this patient as the beginning of a hydronephrosis which would eventually destroy the kidney. McEachern, however, reported that in a patient of his neither the ureter nor the renal pelvis was dilated 7 years following an anastomosis after the method of Van Hook, and that with the dye test, indigocarmine appeared in the urine from each ureter in 5 minutes. His report indicates that a ureter may function permanently after repair and that progressive hydro-uretero-nephrosis with renal atrophy is not always the final result of such an operation.

The accidental division or crushing of a ureter during difficult gynecological operations has occurred occasionally even with the most experienced surgeons. While the problem presented by such an accident rarely confronts any one operator, it is still an important one. The sacrifice of a kidney is a serious matter, especially when the remaining kidney has not had opportunity for gradual compensatory hypertrophy. Consequently, ligation of the proximal end of the cut ureter or nephrectomy is a regrettable procedure. If the division of the ureter is distal enough to allow implantation of the proximal end into the bladder, that procedure is undoubtedly the one of choice.

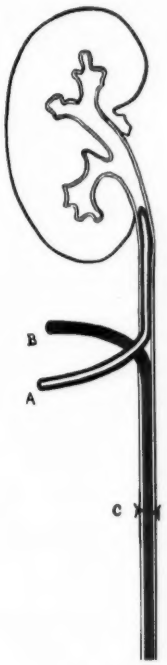

Fig. 1. *A*, Rubber urethral catheter inserted to the renal pelvis through a slit in the side of the ureter. *B*, Second catheter or sound inserted into the ureter toward the bladder through the same slit in the ureter and over which the divided ureter is sutured, *C*, with two fine catgut sutures through all layers except the lining.

However, this method may be impossible of performance because of the high level of the division. It is apparent from clinical and experimental observation that mere suture of the ureter after division results in a low percentage of permanently functioning ureters and that a method of repair offering good chance of permanent function is needed.

Since such an operation is seldom used by any one surgeon, its technique must be simple enough to allow of efficient, rapid performance without previous practice. Leakage of urine at the site of the suture must be absolutely prevented, for its occurrence causes inevitable stenosis. Interference with the flow of urine by traumatic œdema at the anastomosis should not occur. Only by observation after operations satisfying these requirements can it be determined whether or not interference with

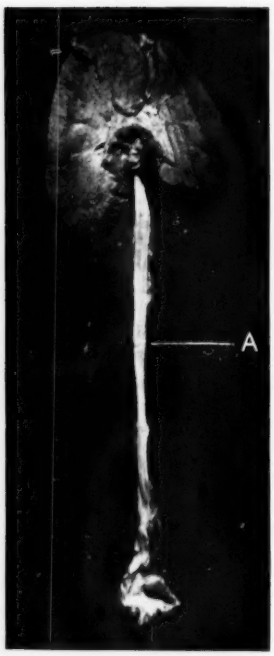

Fig. 2. Photograph of the right kidney and repaired ureter of dog 41 removed 19 days after operation. *A*, Site of suture.

Fig. 3. Photograph of both kidneys and ureters of dog 32 removed 9 months after operation. *A*, Site of suture.

ureteral peristalsis alone can prevent successful result.

In 1923 Dr. L. L. McArthur was confronted with the problem of repairing a traumatically ruptured ureter, the ends of which could be brought only to within an inch of each other. Through a slit in the side of the proximal portion of the ureter he inserted a ureteral catheter distally in the ureter to the bladder, bridging the gap between the ureteral ends. Through the same slit he passed a rubber catheter proximally to the renal pelvis to divert the urine from the gap in the ureter until epithelialization had occurred. The free ends of the catheters were brought out through the wound in the lumbar region.

This method not only prevents gross leakage of urine at the site of anastomosis, but keeps the ends of the ureter free from the irritation of the urine while healing is in progress and insures an unobstructed flow of urine after the operation. The anastomosis is easily performed, as a water-tight union is not essential. This operation applied to the occasional accident of surgical division of the ureter merits consideration. It is the purpose of this study to observe the results of this procedure in conjunction with simple end-to-end suture of the divided ureter.

The operation on the dog is performed retroperitoneally through a lumbar incision, essentially as described by McArthur, except that two fine catgut sutures through all layers of the ureter exterior to the lining are used to bring the ends of the ureter in apposition (Fig. 1). The catheter for drainage of the urine is a No. 8, rubber, urethral catheter which fits the lumen of the ureter snugly and prevents the flow of urine between it and the ureteral lining. The catheter over which the ureter is sutured should also fit snugly so that the full caliber of the ureter will be maintained. Ureteral and urethral catheters or small sounds may be used. The catheters are removed after 8 to 14 days. There is a urinary fistula for only a few days, and inasmuch as this fistula has its origin at the slit in the

SUMMARY OF EXPERIMENTAL OBSERVATIONS

Dog	Time animal killed after operation	Condition of ureter	Condition of renal pelvis	Histological examination of kidney
41	19 days	Non-narrowing healing No dilation; No peri-ureteral thickening (Fig. 2)	Normal	No marked change.[1]
40	22 days	Non-narrowing healing No dilation; No peri ureteral thickening (Fig. 2)	Normal	No marked change.[1]
19	31 days	Non-narrowing healing No dilation; No peri ureteral thickening (Fig. 2)	Normal	No marked change.[1]
30	56 days	Non-narrowing healing No dilation; No peri-ureteral thickening (Fig. 2)	Normal	No marked change.[1]
39	64 days	No dilation; Non-marring healing; Slight periureteral thickening not circular	Normal	No marked change.[1]
32	9 months	Slight dilation; Non-narrowing healing; very slight periureteral thickening (Fig. 3)	Normal	No marked change.[1]

[1] Histological examination was made of the kidneys on the side of the repair and also of the opposite kidney of dog 32. In one section of the cortex of the latter were four, minute, recent abscesses. In four of the other kidneys (30, 32, 39, and 41) were scarred places in the cortex, only one to a section, the largest 4.5 millimeters in diameter, some with large mononuclear cells and occasional polymorphonuclear leucocytes. In no kidney was there the cellular infiltration or fibrous tissue change in either the cortex or the medulla, to be expected with any considerable damage to the kidney.

ureter instead of the point of total division, no constriction results. In fact the slit is practically invisible to the naked eye a few weeks after removal of the catheters. In man, when the operation is performed after accidental division of the ureter, the same procedure is carried out from within the abdomen, the catheters being carried out through a stab wound in the abdominal wall in the lumbar region.

RESULTS

A. Experimental observations. In all the dogs with repaired ureters in which urinary drainage was maintained for 8 days or longer good non-narrowing healing occurred. The number of these animals as listed in Table I is small because of the difficulty of maintaining urinary drainage for sufficient time in active animals. Twenty-six dogs were operated on. Six died within 2 weeks, one from postoperative wound infection, 3 from pneumonia, and 2 during the operation. Five are still living and in 9 the catheters were dislodged before the end of the 8 day period.

Fig. 4. Left pyelo-ureterogram of patient taken 50 days after suture of the ureter.

B. Clinical observation. We are indebted to Drs. A. H. Curtis and H. O. Jones of the gynecological service of St. Luke's Hospital for permission to report these observations.

The left ureter of Mrs. L. P., age 33 years, was sutured by Dr. H. O. Jones immediately after accidental division during a difficult dissection of a large pelvic inflammatory mass. The technique of the repair was essentially as that described. However, the ureteral catheter over which the suture was performed did not fit snugly and its distal end was left in the bladder, the opposite end remaining in the ureter. The rubber catheter had a solid tip and was fitted snugly into the ureteropelvic junction. There was absence of urinary drainage for 3 days which was probably caused

Fig. 5. Left pyelo-ureterogram of patient taken 5 months after suture of divided ureter.

Fig. 6. Left pyelo-ureterogram of patient taken 9 months after operation.

by the close apposition of the ureteral lining to the opening in the side of the catheter. The rubber catheter was removed on the seventh day after the operation and the ureteral catheter 2 days later by way of the urethra. The urinary fistula was entirely closed 7 days later.

Observation 1 50 days after operation: (a) There are no symptoms referable to the left kidney or ureter. (b) The urine from both ureters is sterile. (c) Pyelogram (Dr. E. L. Jenkinson). The left kidney pelvis and calyces are filled with an opaque solution. They are apparently normal. The ureter is tortuous throughout and has a sharp kink at the level of the transverse process of the fifth lumbar vertebra. The ureter, however, is patent throughout (Fig. 4).

Observation 2 148 days after operation: (a) There are no symptoms referable to the left kidney or ureter. (b) The urine from both ureters is sterile. (c) The urine flows from both ureters in spurts. (d) Pyelogram (Dr. E. L. Jenkinson). The left ureter contains a catheter, is filled throughout, is rather tortuous, and has a definite angulation at the level of the transverse process of the last lumbar vetebra. The left renal pelvis and calyces are filled with an opaque solution. The pelvis is normal. The calyces have retained their cupping, except in the ureterogram where they appear somewhat clubbed. This may be due to increased pressure of injection (Fig. 5). (e) After injection of 1 cubic centimeter of phenolsulphonephthalein intravenously, the dye appeared in the urine from the left ureter in 5 minutes and in that from the right ureter in 5.5 minutes.

Observation 3 10 months after operation: (a) There are no symptoms referable to the left kidney or ureter. (b) The urine from both ureters is sterile. (c) The urine flows from both ureters in spurts. (d) Pyelogram (Dr. E. L. Jenkinson). The left renal pelvis and calyces are filled with an opaque solution. The calyces have retained their cupping. The ureter is

rather redundant and shows an acute angulation at the level of the transverse process of the fifth lumbar vertebra. There is a short region of narrowing in the lower third of the ureter at the level of the second sacral segment. However, the opaque solution passes freely (Fig. 6). (e) After the intravenous injection of one cubic centimeter of phenolsulphonephthalein, the dye appeared in the urine from the left ureter in 7.8 minutes and in that from the right ureter in 7.5 minutes. The specimens were of approximately the same depth of color and of equal amounts.

SUMMARY

The ureters of 6 dogs, examined 19, 22, 31, 56, 64, and 270 days after division and suture, with exclusion of urine from the site of repair and with maintenance of the full caliber of the ureter, healed without narrowing or appreciable dilatation of the lumina, with a minimum scar, without change in the renal pelves and without evidence of any considerable damage to the kidneys.

Ten months after a similar operation in a woman the ureter was found to be very slightly dilated with the renal pelvis and calyces not appreciably altered.

It is realized that no final conclusions are warranted by this small series of observations over a limited period of time. Nevertheless, the results merit further careful study.

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ACTINOMYCOSIS OF THE URINARY TRACT

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THAT actinomycosis, a parasitic disease of lower animals known familiarly as "lumpy jaw" in cattle, frequently attacks the urinary tract in the human, is a fact of which the writers were until recently only vaguely aware. A review of the literature following the belated recognition of two instances of renal actinomycosis in our own practice proves significantly a relative frequency of urinary tract involvement.

The majority of reported cases, however, are those in which the disease was secondary in the kidney, ureter, or bladder, either by direct continuity from other sources or by lymphatic or hæmatogenous extension. We wish to add to the 9 recorded cases of primary renal actinomycosis, 2 of our own, and have tabulated all available data relative to the cases on record for ready reference. Certain of our clinical notes should prove of diagnostic value. Peacock in 1925 reported a case of actinomycosis of the kidney with a brief general discussion of the disease. Certain omissions in the two pathological reports make his case somewhat questionable in spite of a convincing history. We mention this because it is often difficult to secure all the tissues desired for examination, or in fact to obtain the postmortem examinations necessary for absolute accuracy. In the 2 case records to follow, it will be apparent that autopsies were virtually impossible; that certain of our deductions are reached by reasonable exclusion and not proved by unassailable laboratory evidence.

Actinomycosis should be considered a systemic, not a local, disease; hence involvement of any portion of the human body is readily understood; that selectivity does not follow, although the commonest sites are the head and neck, and the next most common, the abdomen. The parasite entering the digestive tract has its first opportunity there or in adjacent parts. So also, pulmonary involvement follows breathing of dust containing the organisms. Hæmatogenous dissemination may necessitate actual lesions elsewhere for propagation and entrance to the blood stream; if this is true, such a primary focus may be self-limited or unrecognized.

Laboratory studies of the fungus are not altogether satisfactory; cultures from the abscesses are not often diagnostic and the presence of pyogenic bacteria prove misleading. Bevan was able to recognize the disease by the discharge from an abscess sinus although the smears were negative for actinomyces; by later tissue examination the diagnosis was confirmed. It is significant that the two conditions most often confused with actinomycosis of the kidney are tumor and tuberculosis. In his treatise on kidney tumors, Garceau devotes an entire chapter to this disease.

The effects of the fungus in tissues are suppuration, necrosis, granulation, connective tissue formation. Thus it localizes itself to a degree, although when it involves a large area, it is accompanied by a marked reaction in the surrounding parts as indicated by Bevan, who stressed the board-like infiltration of the abdominal wall and flank due to a perinephritic abscess with renal actinomycosis. The individual lesion, if specifically due to the ray fungus, appears as a collection of yellowish granules of varying solidity, depending upon the age of the process. Microscopically the radiating groups of actinomyces are quite characteristic, forming a series of granules which border an abscess if such has developed. The actual diagnosis depends upon the finding of ray fungi; occasionally they can be demonstrated in the pus from an abscess; they are often present in the granulations obtained by curetting the lesion, and always in the tissues themselves.

In urinary tract invasion, the urine may show actinomyces; they were found in the urine following nephrectomy in Kunith's case; in one of our cases, organisms similar to tubercle bacilli were found and so reported by excellent laboratory workers. Other observers report this same type of bacilluria.

In addition to those mentioned, J. Israel, Kunith, Kleinschmidt, Abbott, Cohn, Kellock, and Cecil and Hill, have reported cases of actinomycosis involving the urinary tract alone. The ureter and bladder appear to be less often involved than the kidney, from which extension is rare. The accompanying tables show in outline the authentic cases of urinary tract invasion which we have collected. We have added one case in which there was unilateral renal actinomycosis in a patient with bilateral polycystic kidneys. The extension was apparently from the liver and the diagnosis was made at postmortem.

Israel called attention to the definite similarities between actinomycosis and tuberculosis of the kidney, in regard to pathogenesis, clinical appearance, and anatomical localization. We have found that the clinical course, postoperative, is also similar to that following nephrectomy for tuberculosis. Kleinschmidt, who pointed out that actinomycosis cannot be strictly primary, in the kidney, since the "infection" is brought about by the way of the blood stream from some unrecognized colonization focus, described in his case report an apparently early and rapidly-developing lesion, the kidney having preserved normal dye elimination; he described the involved area as appearing like an infarct. The salient points in diagnosis stressed by all who have reported renal cases are: (1) localized pain, (2) fever and prostration, (3) muscular rigidity, (4) loss of weight, cachexia, and (5) palpable tumor mass. The first three items obviously belong to an acute condition which in our opinion is likely due to secondary infection and in renal actinomycosis manifested by perinephritic suppuration. The other items suggest a chronic debilitating disease, hence the natural confusion with tumor, which was further enhanced in one of our own cases by the pyelographic findings and severe secondary anæmia. We believe anæmia is universal with long-standing actinomycotic foci; it was a most important symptom in both of our cases, and has not heretofore been sufficiently stressed.

Normal urine was noted in one of Israel's case reports, in Kleinschmidt's record, and in our first case. Hæmaturia occurred in the patient upon whom Bevan made the diagnosis of renal actinomycosis, and was one of the presenting symptoms in Abbott's case and in Israel's earlier case. Our second case showed recurring hæmaturia, suggesting tuberculosis. In the reports of secondary renal involvement, urine changes suggest various degrees of nephritis, and the finding of albumin and casts was common. Study of the urine and even of renal function, does not appear of any specific aid, in that there may be variations from normal urine (in early involvement) to those changes suggesting almost any other renal disease, and finally a complete renal functional loss and the cessation of secretion in the affected kidney. Certain agglutination tests and serum reactions have been attempted as diagnostic aids. Dixon, working in Warthin's laboratories, produced material corresponding to Koch's tuberculin which he called "actinomycin." In a considerable series of cases and in animal experimentation, it proved of no diagnostic value.

CASE REPORTS

CASE 1. Mr. R., aged 58 years. Family history was negative. Patient had had typhoid, chicken pox, measles, whooping cough, and mumps. He had lived in cities all his life, and had no contact with animals.

Present illness dated back to January, 1927, when the patient consulted a physician complaining of a general run down condition, low blood pressure, and an inability to gain strength or ambition. This weakness was very noticeable and was associated with gastro-intestinal upsets. For 3 years previous there had been nocturia of once a night, increasing during the latter part of 1926 to three or four times a night. A blood count in January, 1927, showed, hæmoglobin 80 per cent; red blood cells 3,940,000; white blood cells 12,250, polymorphonuclear leucocytes 74 per cent. The red blood cells were normal in size, shape, and staining qualities. Urine was normal. X-ray examination showed the lungs and heart negative. A gastro-intestinal series showed a pressure defect on the greater curvature of the stomach which corresponded with the position of a shadow which had the appearance of an enlarged kidney in a previous film. There also was a depression on the jejunum from the same mass. Following the barium enema there was noted a downward displacement of the splenic flexure.

Following treatment by the attending physician, the patient was sent to Hot Springs, Arkansas. He was examined again at this time, March, 1927. Blood pressure was 135—75; Wassermann, negative; hæmoglobin 60 per cent; red blood cells 3,870,000;

Fig. 1. Case 1. Left pyelogram. Note distortion of ureter and practical obliteration of pelvis suggesting renal tumor.

white blood cells 9,066; polymorphonuclear leucocytes 65 per cent. Urinalysis showed large amounts of pus cells in clumps. A cystoscopic examination revealed a normal bladder; both ureters were catheterized and specimens from the right kidney showed many pus cells in clumps, and on culture, colon bacilli. Specimen from the left kidney, normal. Kidney function test showed a slight delay on the right side. There were no pyelograms made. A diagnosis of secondary anæmia plus a pyelitis of the right kidney was made. The treatment consisted of four dilatations of the right ureter and lavage of the pelvis. The patient was reported much better after the second treatment. Iron and arsenic were given intravenously, as were small doses of mercurochrome and glucose. Following this method of treatment, the urine was free from bacteria and showed only an occasional pus cell.

Upon returning to Detroit 8 weeks later, his urine showed a slight trace of albumin and a moderate number of pus cells. The blood showed an increase of hæmoglobin to 74 per cent; red blood cells 3,920,000; white blood cells 12,050; and polymorphonuclears 67 per cent.

June 7, 1927, the patient was referred to a urologist. A cystoscopy revealed a normal bladder; cultures from the right kidney were negative; while the specimen from the left kidney cultured colon bacilli. As far as can be ascertained there was not a differential function test and no pyelograms were taken at this time. The patient was advised to have his tonsils removed. This was done in July. He was also given intravenous injections of iron and arsenic at this time, and had two infected teeth extracted.

August 1, 1927, he consulted the writers. The blood showed at this time, hæmoglobin 65 per cent; red blood cells 3,600,000; white blood cells 11,800; polymorphonuclears 58 per cent. The red blood cells showed a slight variation in size, shape, and were paler than normal. Physical examination was negative except for several bad teeth and a palpable mass in the left kidney region. There had been a weight loss of 30 pounds in 8 months; this was noticeable, the patient's skin being pale and flabby. He stated positively that the mass in his upper left side had not been previously found.

Cystoscopy August 3, 1927. Bladder was normal; both ureters were patent; No. 6 catheters passed into the kidney pelves readily. Drainage was free from right, scant from left. Indigo carmine appeared in abundance from right kidney in 4 minutes, and only a faint trace appeared from the left kidney 20 minutes after intravenous injection. A left pyelogram was taken with 15 cubic centimeters of sodium iodide solution. Most of this escaped into the bladder, but the distorted pelvis and ureter were well outlined.

Stereoscopic films were made of the lumbar spine, pelvis, and chest, with single films of the femora and long bones of the upper extremity. There was no evidence of bony malignant metastases. There was a moderate bilateral apical pleuritis which was probably an old process.

The patient was referred to a clinic for complete examination. The diagnosis of renal tumor was concurred in and 6 weeks' pre-operative treatment advised. This consisted largely of a series of three blood transfusions, checked by frequent blood counts; rest and high caloric diet. Electrocardiagrams; a new set of gastro-intestinal roentgenograms, and daily urine studies failed to add any positive findings.

September 18, 1927, the patient entered Grace Hospital. At this time the blood showed, hæmoglobin 80 per cent; red blood cells, 4,040,000; white blood cells, 12,400, of which 73 per cent were polymorphonuclear leucocytes. Non-protein nitrogen was 35.5 milligrams per 100 cubic centimeters. Urine showed many pus cells and amorphous crystals. Pre-operative diagnosis: malignant tumor of left kidney.

An operation was performed on September 20. A transverse abdominal incision was made extending from a point opposite the middle of the twelfth rib forward to the umbilicus. This incision was extended upward in the midline to the ensiform. The fascia and muscle including the rectus were separated in this line of incision and the peritoneum opened likewise, thus exposing the tumor mass, which could be seen protruding below the costal border. A long incision was made through the

Fig. 2. Case 2. Right pyelogram. Note distortion of ureter and obliteration of pelvis. Perinephritic abscess present, but tumor suggested as by pyelogram in Case 1.

Fig. 3. Case 2. Right pyelogram. Six months after drainage of perinephritic abscess. Note dilatation of ureter and extensive changes in calyces suggesting tuberculosis. Bismuth paste in sinus below pelvis of kidney.

mesocolon and an attempt made to incise the peritoneum, which, however, was so intimately adherent to the tumor as to make incision impossible. With a combination of blunt and sharp dissection, the tumor was freed on all sides outside the fatty capsule. This latter structure was extremely dense and fibrous and did not contain the usual amount of fat. The principal adhesions were anterior and inferior to the kidney. Large blood vessels extending, apparently from the surface of the tumor to the mesocolon and peritoneal structures were found. It was necessary to ligate several of these to control hæmorrhage and facilitate the removal of the tumor. At one point the omentum was adherent through the peritoneum. The pedicle of the kidney mass, including the ureter, was clamped and the tumor cut away cleanly. In view of the loss of blood and poor condition of patient it was deemed advisable not to attempt ligation of the pedicle so that the wound was closed with free drainage, leaving the clamps in place.

A hypodermoclysis of 1,000 cubic centimeters of saline and 30 minims of adrenalin was given immediately. The pulse being imperceptible, caffeine sodium benzoate and camphor in oil were given at intervals. The patient was kept in Trendelenburg position for a considerable time in the operating room.

After operation, there was a moderate amount of hæmorrhage, and in view of the patient's age and secondary anæmia it was thought that this might prove severe. There was definite shock. A transfusion of 500 cubic centimeters of whole blood was given 5 hours after the operation. The following morning the patient was seen by an internist, in consultation, who, after careful examination, stated that although there was some evidence of myocarditis, the patient's condition was good. However, the patient expired that evening having displayed a gradual lowering of blood pressure and cardiac failure. Inasmuch as the true nature of the disease was not suspected, only a casual request for autopsy was made. This the family refused. The pathological report stated that the specimen had the gross appearance of "hypernephroma." Microscopically the entire lesion proved to be actinomycosis.

CASE 2. Miss J. D., aged 36 years. Family history was negative. Patient had had the ordinary diseases of childhood, and pneumonia and pleurisy, in 1924. On October 31, 1927, an appendectomy was performed upon the patient. The pathological report was chronic, atrophic appendicitis. Her convalescence for 2 weeks was uneventful. November 15, some pain was noticed in the right kidney region.

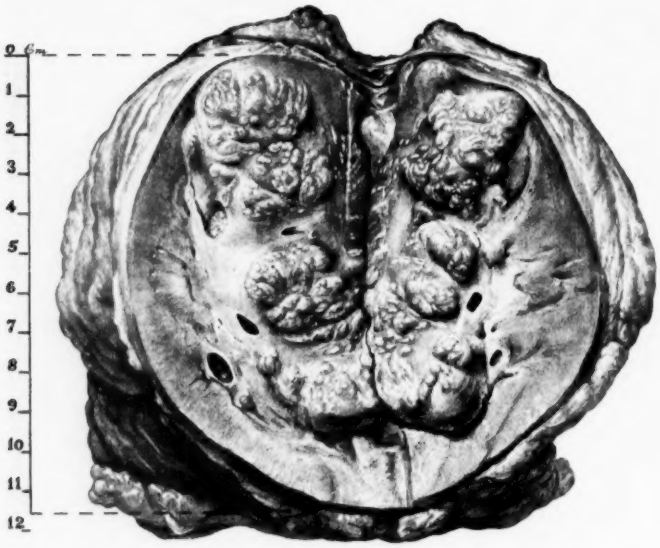

Fig. 4. Case 1. Scale drawing of specimen. Right kidney with fatty capsule intact. Extensive involvement by actinomycosis.

A diagnosis of "neuritis" was made at this time by the attending physician. A short time later a fair-sized swelling appeared in the right lumbar region, which was incised, and a cupful of pus obtained. Drainage from this wound was constant. During the month of December the patient ran an afternoon temperature, had night sweats, and lost 25 pounds in weight.

She was admitted to Grace Hospital, December 26, 1927, having in the meantime been referred to Dr. Frank E. Curtis with a diagnosis of tuberculosis of the spine. This condition was ruled out by X-ray with the aid of Beck's paste injected into the sinus and by laboratory study of the pus discharge. Dr. Curtis suspected a kidney condition and referred the patient to the writers. Previous to this, however, Dr. Curtis had suspected actinomycosis because of the somewhat characteristic pus and the history that the patient had spent many summers in the North of Michigan, during which time the only water available for drinking purposes was that which was obtained from a spring which each winter was contaminated by cattle. Laboratory examinations, however, were negative for both actinomycosis and tuberculosis. The patient at this time showed a white blood count of 42,300 with 91 per cent polymorphonuclear leucocytes.

Cystoscopy on December 29, 1927, revealed a normal bladder throughout. Both ureters were catheterized with ease. Dye appeared from right kidney in 6 minutes and from left kidney in 4½ minutes. The dye was scant on the right. A right pyelogram after three attempts to inject the pelvis, a total of 48 cubic centimeters of sodium iodide solution being used, showed only a faint outline of the pelvis, the ureter seemingly being stretched around a tumor mass. Most of the solution was in the bladder. Guinea pigs were inoculated at this time and 6 weeks later at postmortem were negative. The differential urine showed many pus cells from the right kidney, a few from the left and negative cultures. A diagnosis of perinephritic abscess, probably tuberculous, was made at this time.

The patient continued to run a septic temperature and on December 31, 1927, the abscess was drained through a right lumbar incision. There was marked infiltration and fibrosis of the perirenal tissues and, inside the fatty capsule, opposite the lower pole of the kidney a large pus pocket was found and evacuated. The kidney was free inside the fatty capsule and practically normal with the exception of the lower pole which was entirely destroyed. Palpation disclosed the renal tissue to be crushed and thread-like. The incision was left open with adequate drainage.

After operation the patient ran a temperature ranging from normal in the morning to 102–103 degrees F. in the afternoon. Blood counts showed a gradual decrease of the leucocytosis to 12,300. On January 18, 1928, the non-protein nitrogen was 24 milligrams per 100 cubic centimeters, and January 20, a blood culture was negative after 72 hours. The red blood count dropped to slightly over 2,000,000 and the hæmoglobin to 50 per cent. Re-

Fig. 5. Case 2. Actual photograph specimen. Note extensive involvement of entire left kidney. Lower pole contracted following perinephritic abscess with drainage. Actinomycosis only lesion found.

peated examinations of the urine for acid fast bacilli were negative, as were examinations of the pus for both tubercle bacilli and actinomycotic organisms. At operation, the pus was again thought suspicious of actinomycosis.

A second cystoscopy on February 1 gave the same bladder findings. Upon catheterizing the right ureter, an obstruction was met at 7 centimeters. After some manipulation the catheter was passed to the region of the kidney where another obstruction was met. Bilateral function as determined with phenosulphonephthalein showed appearance from right kidney in 9 minutes and from left kidney in 4 minutes. Again the dye was scant on the right side. A pyelo-ureterogram showed multiple strictures of the ureter with irregular areas of pelvic dilatation. There was pyonephrosis, involving the upper and lower major caliceal areas, with disturbance of the kidney substance adjacent. The pyelogram was typical of a moderately advanced tuberculosis.

A blood transfusion was given on February 10, and on the 18th the patient was discharged to return later for nephrectomy. Between this date and the second admittance the patient failed to gain in weight and strength and had a persistent purulent discharge from the sinus.

The second admittance was on April 15, 1928. At this time there was a low hæmoglobin and red cell count. The white blood cells had increased to 16,000, of which 90 per cent were polymorphonuclear leucocytes. Non-protein nitrogen was 21 milligrams per

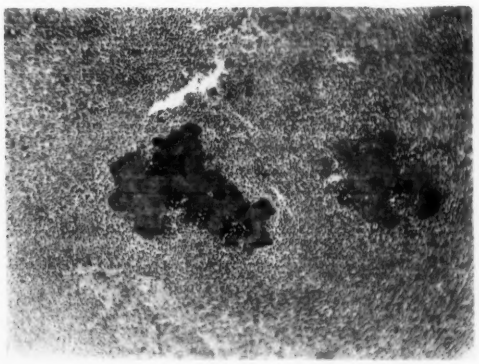

Fig. 6. Case 1. Microphotograph specimen from left kidney. Note inflammatory reaction and colonies of ray fungi.

100 cubic centimeters. Two blood transfusions were given, April 19, and April 24, 1928. On this latter date and the following day, acid fast bacilli were reported in the urine. April 25, the patient was operated under local infiltration of ½ per cent novocain with a preliminary administration of scopolamin and morphine. The kidney was bound down by numerous adhesions and was very difficult to free. After the application of clamps to the vascular pedicle and the ureter, the kidney was removed. Because of the poor condition of the patient it was deemed advisable not to tie the pedicle and the clamps were left in the wound.

For weeks following operation the patient ran a septic temperature. She then began to complain

Fig. 7. Case 2. Microphotograph specimen from right kidney. Note glomeruli and colony of ray fungi.

TABLE I.—TO KIDNEY BY METASTASIS

Physician	Sex and age	Primary lesion	Secondary lesion
1. J. Israel	F., 39	Lung	Both kidneys enlarged and pale and showed miliary abscesses. Masses of organisms found.
2. J. Israel	F., 31	Doubtful	Heart, breast, spleen, liver and brain. Left kidney showed miliary abscesses with typical pus.
3. O. Israel	F., 44	Doubtful	Lungs, diaphragm, spleen, stomach, and one kidney.
4. Kohler	F., Adult	Skin	Brain, tongue, spleen, and colon. Cortical abscesses in both kidneys.
5. F. B. Mallory	F., Adult	Doubtful	Liver, lungs, brain. Large cortical abscesses in kidneys.
6. Martin	M., 16	Mouth	Brain and lungs. Cortical abscesses and parenchymatous degeneration in both kidneys. Organisms in abscesses.
7. Moody	M., 43	Upper jaw	Liver. Left suprarenal capsule. Suppurating process in left kidney.
8. Moosdorf	M., 21	Lung	Kidney, heart. Left kidney enlarged with suppurating focus full of yellow granules.
9. Petroff	M., 26	Jaw	Abscesses in both kidneys full of characteristic organisms.
10. Poncet and Berard	M., 48	Lungs	Miliary abscesses in kidneys.
11. Sabrozès and Revière	M., 32	Doubtful	Brain and suppurating kidney infarct.
12. J. E. Davis and R. E. Cumming	F., 40	Liver	Bilateral polycystic kidneys and actinomycosis of kidney.

TABLE II.—TO KIDNEY BY CONTINUITY

Physician	Sex and age	Primary lesion	Secondary lesion
13. Grill	F., 25	Right lumbar region	Appendix, several purulent foci in right kidney.
14. Grill	F., 25	Cæcal region	Liver and kidney.
15. Aschoff	F.	Lungs	Liver, left kidney pale and cloudy with nodules on surface.
16. Hoover	M., 43	Jaw	Neck, chest, liver, spleen, lungs and both kidneys.
17. Rowland	M., 22	Carious tooth	Lungs, cæcum, appendix, thigh. Left kidney pelvis filled with pus, deposits of actinomycosis in lower third of organ, also amyloid degeneration.
18. Vanderstresten	M., 22	Lungs	Liver, right kidney, grayish with purulent infiltration and destruction of tissue.
19. Ponfick	F., 24	Tonsils	Lungs, diaphragm, liver, and abscesses in both kidneys.
20. Grill	M., 15	Rectum	Abscess extending from appendix and invading right kidney.
21. Langenbeck	M., Adult	Doubtful	Prevertebral abscess extending to and invading left kidney.
22. Grill	M., 50	Appendix	Abscess extending to right kidney and liver.
23. Grill	M., 52	Colon	Extending to right kidney and liver.

of some pain in the left shoulder and left leg. This developed into pyemic abscesses: (1) left shoulder joint posteriorly, (2) left thigh, middle and lower third, and (3) left leg, inner surface, upper one third. These were incised on June 21 by Dr. Curtis and pus obtained from all the wounds. This cultured pure staphylococcus and in smears did not show actinomyces. These wounds drained for a considerable length of time and finally healed. Meanwhile the kidney had been sectioned and the pathologist reported actinomycosis. Increasing doses of potassium iodide were then given, and during the next 8 weeks, blood transfusions were given, the severe anæmia having persisted.

The lumbar wound healed completely in 2 weeks. On or about July 1, 1928, the urine began to show blood, and on July 14 while sitting up the patient's jaws became set and the muscles of the arms began to twitch and finally go into tonic contractions. This lasted about 15 minutes following which the patient had a severe headache. The patient was discharged July 28, 1928, to go home, after which blood was still present in the urine. In the latter part of August there developed a marked œdema of the face, hands, and legs. There were also interval attacks which were similar to the one which has been previously mentioned and on August 20 the patient expired.

As the patient's home was at a distance in the country and as neither of the writers were in attendance at that time, an autopsy could not be obtained.

TABLE III.—LESIONS SECONDARY IN KIDNEY NOT ACTINOMYCOSIS

Physician	Sex and age	Primary lesion	Secondary lesion
24. Von Baracz	M., 45	Lungs	Retrobronchial glands, ribs and sternum. Fatty degeneration in kidneys.
25. Poncet and Berard	M., 37	Liver	Lungs. Chronic parenchymatous degeneration in kidneys.
26. Duckworth	M., 19	Lungs	Diaphragm, slight congestion of both kidneys.
27. Grill	M., 26	Stomach	Lungs, spleen, ribs, diaphragm, pericardium, abdominal wall, chest, and arm. Left kidney, large, firm and anæmic. Right kidney, small and congested.
28. Hanau	F., 40	Lungs	Vena cava, pericardium. Kidneys large and hard.
29. Grill	M., 28	Ascending colon	Liver, lungs. Amyloid degeneration in kidneys.
30. Koch	M., 28	Lungs	Pleura, diaphragm, colon, spleen, peritoneum. Chronic nephritis and beginning parenchymatous degeneration.
31. Langhans	M., 51	Cæcum and appendix	Liver. Kidneys large and congested.
32. Partsch	M., 35	Cæcum	Hip joint. Amyloid degeneration of kidneys.
33. Partsch	M., 32	Skin	Intestines and liver. Amyloid degeneration of kidneys.
34. Rowland	M., 27	Cæcum	Lungs, fatty degeneration in kidneys.
35. Sammter	M., 30	Lungs	Amyloid degeneration of kidneys.
36. Schabad	M., 62	Lungs	Pleura and ribs. Interstitial nephritis, chronic.
37. Weigert	M., 35	Skin	Pleura, diaphragm, liver. Kidneys enlarged, amyloid degeneration.

TABLE IV.—KIDNEY PRINCIPALLY AFFECTED

Physician	Sex and age	Primary lesion	Secondary lesion
38. Earl	M., 49	Kidney ?	Brain—In kidney the lower third was a firm mass with a number of small cavities in groups and containing thick yellow pus.
39. Stanton	M., 53	Intestine	The pyramids and cortex of the kidneys were streaked with yellowish gray lines of purulent infiltration. Many abscesses with typical colonies.

TABLE V.—TO URETER BY CONTINUITY

40. Ammentorp	M., 25	Appendix	Focus in appendix with extension to the ureter and bladder.

It is interesting to note the early diagnoses made in these cases of so-called primary actinomycosis. As stated, Bevan recognized the true condition; Kleinschmidt operated for a renal mass, not recording a diagnosis; Peacock suspected tuberculosis of the involved kidney. In our second case, thinking we had ruled out actinomycosis, and having found acid-fast bacilli in the urine, a pre-operative diagnosis of tuberculosis was made. This patient presented the wooden infiltration over an extensive area along the lumbar muscles adjacent to the spine and also anteriorly as far as the mid-line, said by Bevan to be suggestive of actinomycosis. This was the likely basis for the early diagnosis of vertebral tuberculosis. The perinephritic abscess did not entirely disappear after incision but remained present until after nephrectomy. Israel's earlier case, treated over 4 years for hæmaturia and suppurative pyelitis including nephrotomy, finally developed nodules in the superficial part of the lumbar scar; following the incision of these a permanent fistula developed with purulent discharge in which actinomyces were found. So with a positive diagnosis, nephrectomy was performed. Israel's second case was operated upon with a diagnosis of suppurating perinephritis, as was that of Kunith. In two of the remaining instances (Abbott's case and our second case) a pre-operative diagnosis of malignant renal tumor was made with logical evidence clinical and urological. Summarizing the diag-

TABLE VI.—PRIMARY ACTINOMYCOSIS OF KIDNEY

Physician	Sex and age	Summary of pathology
41. J. Israel	M., 33	Left kidney involved. Lower third of organ practically unchanged. Upper two-thirds show characteristic actinomycotic changes. Calculus in pelvis described as "fossilized mass of organisms."
42. Kunith	M., 4½	Right kidney—enlarged, nodular and hard. On section, small, grass green granules exuded from the tissue. All of central portion of kidney riddled with small grayish white abscess cavities. Lower pole showed fatty degeneration.
43. J. Israel	F., 60	Left kidney was enlarged. In the upper half of kidney, in the region of the medullary substance there was a tumor-like yellowish focus containing actinomycotic granules.
44. Kleinschmidt	M., 24	Left kidney was wedge shaped. There were yellow granules, consisting of accumulations of leucocytes surrounded by young granulation tissue, which contained numerous cells. There were also lipoid substances.
45. Bevan	?	The kidney was incorporated in a large massive abscess containing abundant colonies of actinomyces.
46. Abbott	F., 43	Lungs, fourth and fifth lumbar vertebræ, left sided psoas retroperitoneal abscess. The kidney on section had a yellowish appearance. Large numbers of ray fungi were found in the granulation tissue of the kidney.
47. Cohn	M., 46	Pyelonephritis: prostatitis. Organisms found in urine.
48. Kellock	F.	Right kidney affected. Pathology not stated.
49. Cecil and Hill	?	Pyelonephritis.
50. R. E. Cumming and R. J. Nelson	M., 58	Left kidney was enlarged, 15 cm. by 7½ cm. by 7 cm. Fatty and fibrous capsule densely adherent. On section there was normal kidney tissue around the periphery, 2½ cm. in thickness. The medulla and lower pole contained an irregular mass which was tough and fibrous on cutting. Microscopic section showed typical ray fungi and characteristic granulation tissue of actinomycosis.
51. R. E. Cumming and R. J. Nelson	F., 36	Right kidney was enlarged, 11 cm. by 7 cm. by 7 cm. Lower pole only half the size of the upper pole. Capsule densely adherent. Section shows only a little kidney tissue remaining. The bulk being made up of a yellowish colored tissue very dense and fibrous. Ray fungi present with typical granulation tissue of actinomycosis.

noses: actinomycosis, 2 cases; renal tuberculosis, 2 cases; malignant tumor, 2 cases; suppurative perinephritis, 2 cases; renal mass, 1 case.

In this summary Peacock's case is included although it does not appear in our tabulated record for reasons given above. Perinephritic suppuration occurred in 5 cases.

PROGNOSIS

With such a small series, the prognosis of urinary tract actinomycosis can be discussed with little profit. Of the 8 cases, 4 apparently recovered and 4 died; all were subjected to nephrectomy. Considering all the reported instances with renal and ureteral involvement, there have been few permanent recoveries. This is undoubtedly based upon the insidiousness of the disease, its general dissemination and debilitating characteristics.

TREATMENT

If the diagnosis is made early and the active disease is confined in the kidney, nephrectomy should be the obvious procedure. With perinephritic suppuration, it still affords the only probable cure and had best be done in two stages as advocated for serious renal and perirenal suppurative processes by Crosbie. The persistent sinuses associated with a deep seated focus are a typical surgical problem but are self-healing after the removal of the kidney and simple stimulative treatment. X-ray exposure and light therapy may be of value. For the active actinomycotic process, wherever located, X-ray treatment is advocated but we have not found convincing proof of its value. It was suggested during the hospital tenancy of our second case but refused by the consulting roentgenologist due to the lack of known results and the poor condition of the patient.

Drug therapy has some theoretical value; the most widely used is potassium iodide, although Garceau stated as early as 1909 that it had proved of little aid in limitation or cure of actinomycosis. Bevan, on the other hand, and more recently states that this drug is of value, especially if given with copper sulphate and administered over long periods.

SUMMARY

1. The urinary tract is a relatively frequent site of actinomycosis which should be considered a systemic not a local disease. The involvement of kidney or ureter is usually secondary, and when the process is apparently confined to the kidney, perinephritic abscess is likely to occur. Bladder involvement has not been reported in available literature.

2. The disease is recognized by finding the typical granules (ray fungi) in the urine, in pus from suppurating areas, or in the tissues themselves. The clinical course, physical findings, and urological evidence, suggest renal tuberculosis or renal tumor. Anæmia is an important sign. The correct diagnosis is rarely made prior to operation.

3. The history often establishes the possibility of actinomycosis in that knowledge of known contact with diseased animals (especially cattle) can be ascertained.

4. The prognosis is very grave, since in secondary involvement the disease is so widespread as to be usually fatal, and when primary in the kidney, is well advanced when treatment is undertaken. Nephrectomy is the best procedure when applicable. X-ray, potassium iodide and copper sulphate are recommended, but are only of accessory value after surgical drainage and removal of the affected organ.

5. We have reviewed 9 previously reported cases of so-called primary actinomycosis of the kidney and added the full clinical data of 2 cases of our own.

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CLINICAL SURGERY

FROM THE RUDOLFSSPITAL, VIENNA

EXTIRPATION OF THE UTERUS BY THE VAGINAL ROUTE

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THE advantages of vaginal extirpation of the uterus over extirpation by laparotomy are so generally recognized that I will not enlarge upon them in the present paper. Even today, however, many operators choose the abdominal method in cases which should be operated on by the vaginal route. The reason for this lies chiefly in the fact that the technical difficulties of the vaginal operation are often overestimated. As a matter of fact vaginal extirpation of the uterus is, except under especially aggravating circumstances, an easy and quickly done operation which every gynecologist should be able to perform. Yet the operation is easy and harmless only when the operator is perfectly familiar with it and is able to indicate to his assistants their necessary actions. Hardly any other operation can be made so difficult by awkwardness and lack of cooperation of the assistants as vaginal uterine extirpation. It is essential, therefore, that a discussion of the operation should include exact directions for the assistants.

The indications for this operation are numerous, and, if confined to the extirpation of the uterus alone without the adnexa, include cases of hæmorrhage especially in climacteric women, in adenomycosis uteri, and in cancer of the uterus; also certain cases of postpartum atony, septic abortion, and similar conditions. No special preparation of the patient is needed. The bowels must have been evacuated and no food is allowed on the day of operation. For anæsthesia ether narcosis, not especially deep, is given. The patient is laid on the table in the usual position for a vaginal operation. The bladder is emptied and the vagina as well as the adjacent parts of the vulva are washed with soap and water and rinsed with a 1 per cent solution of mercury bichloride.

The operator sits before the patient, the first assistant on the left hand of the patient, the second one on her right hand.

There are two typical methods for extirpation of the uterus. One method is called "from the parametria." In this procedure we first tie off the parametria, and then gradually proceed by tying off the tissue against the adnexa until finally the uterus is extirpated. In the second method we begin by turning forward the corpus uteri through the anterior colpocœliotomy wound, amputate the adnexa, and then tie off the parametria and cut through the posterior wall of the vagina. We call this method "from the corpus." The advantage of the first method is that technically it is undoubtedly very much easier; its disadvantage that with the turning forward of an enlarged uterus the ligatures formerly placed on the parametria are easily stripped off, and this may cause a hæmorrhage. The second method avoids this danger as the parametria is tied off last; and another advantage is that if the operator becomes aware during the operation that it is not necessary to remove the uterus, he can save the organ entirely or in part. Yet the second method is considerably more difficult to do than the first. The stripping of the ligatures can be avoided by careful tying, and on account of the greater ease of execution the first method will be described here.

Step 1. The vagina is opened out with two retractors: the posterior so called Martin's retractor, the anterior a short straight one. The posterior retractor is held by the second assistant with his right hand, the anterior by the first assistant, also with his right hand. The operator grasps the anterior lip of the cervix with two tenacula and the posterior lip with one tenaculum and pulls the uterus down as far as possible. This is the time to circumcise the cervix. It is of the greatest importance that the right place on the anterior fornix be chosen for the incision, as this incision governs the ease with which the bladder is detached, the peritoneum is opened and if properly placed it reduces the danger of injury to the bladder. If the cut is made too low toward the lower part of the cervix, and a beginner is inclined to do this, the detachment of the bladder is usually very difficult, as it is hard to get into

Fig. 1. Notice the wide gaping of the wound.

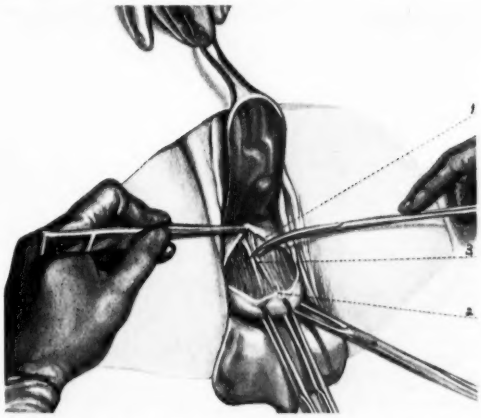


Fig. 2. *1*, Upper cut edge of the vagina; *2*, lower edge; *3*, fold of connective tissue between bladder and cervix.

the right layer of tissue between the bladder and anterior wall of the upper cervix, the parametrium anterius. If the incision is too far removed from the cervix we risk injuring the bladder with the first cut. The correct place for the incision is the junction between the smooth part of the mucous membrane unmovably adherent to the cervix underneath and the wrinkled movable part of the mucous membrane. When traction on the tenaculum is released that place may be distinctly seen. After having found out the right place for incision, one begins with the circumcision of the cervix with a knife in the right anterior fornix, and carries the cut over the anterior wall around the cervix to the point of commencement. While doing this the operator pulls the tenacula with his left hand down to the utmost extent, while the first assistant stretches the anterior wall of the cervix by pressing the retractor into the fornix. The incision is deep enough when the transverse wound gapes at least 1 to 2 centimeters (Fig. 1).

Step 2. Opening of anterior and posterior pouches of Douglas. One begins by opening the vesico-uterine plica. The first assistant grasps with his left hand the tenacula and pulls strongly downward, while with his right hand he loosely holds the retractor in the anterior fornix so that the wall of the vagina remains slack. The operator takes in his left hand a toothed forceps and lifts the edge of the anterior vaginal wall as much as possible. This produces longitudinal folds from the cervix towards the toothed forceps. These folds are cut with curved scissors exactly midway (Fig. 2). It is not good, out of fear of injuring the bladder, to keep too close to the cervix, because then one easily may get into a wrong layer, namely into the upper layers of the cervix, where orientation is very difficult. If the vaginal wall is lifted sufficiently high we may safely cut right in the middle of the fold, rather deeply without endangering the bladder. After cutting these folds the operator grasps with his left hand the tenaculum and pushes the bladder entirely off the cervix with the index finger of his right hand, the fingertip being directed toward the cervix. After a sharp dissection of the lowest fibers with scissors only loose connective tissue is left, which can be easily pushed aside with the finger. The operator must hold the tenacula himself because that gives him the bimanual feeling which enables him not to proceed too strongly or too gently with his finger, and to remain in the right layer of tissue. We are aware that the bladder is entirely moved aside and the peritoneum of the anterior pouch of Douglas freed, in the following way. First, the right index finger feels the anterior part of the cervix which is rough. This is the area from which the bladder was detached. Penetrating deeper the anterior part of the corpus feels quite smooth, a thin membrane is to be felt, movable against the anterior wall of the uterus. This is the peritoneum. One must be careful to see that the bladder is stripped not only in the direction of the fundus but also sufficiently on both sides, so that with the edges of the bladder the ureters are drawn back and are not injured when the parametria are ligated. As soon as the operator has felt the exposed peritoneum with his finger, the first assistant grasps the tenacula with his left hand and pulls them downward, while with his right hand he cautiously inserts the retractor between the

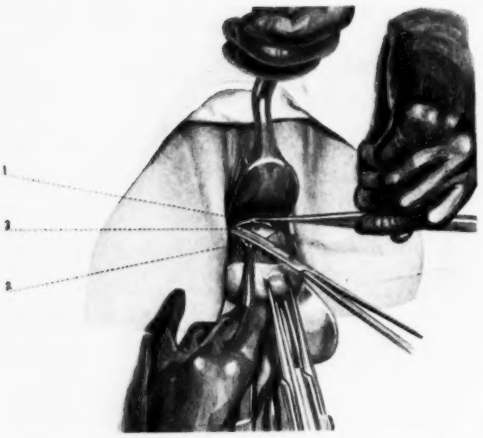


Fig. 3. The detached bladder is held back with retractor. *1*, Upper cut edge of the peritoneum; *2*, lower edge; *3*, anterior part of the corpus uteri.

bladder and uterus. This frees the peritoneum. The operator takes in each hand a toothed forceps and with them lifts the peritoneum into a longitudinal fold. His left hand grasps it near the cervix, that is low down, his right hand near the bladder, that is high up. As soon as the peritoneum is prepared in this way the second assistant takes with his left hand the anterior retractor from the right hand of the first assistant, and the first assistant takes the upper forceps with the peritoneum from the right hand of the operator. The operator with his free hand now takes the scissors

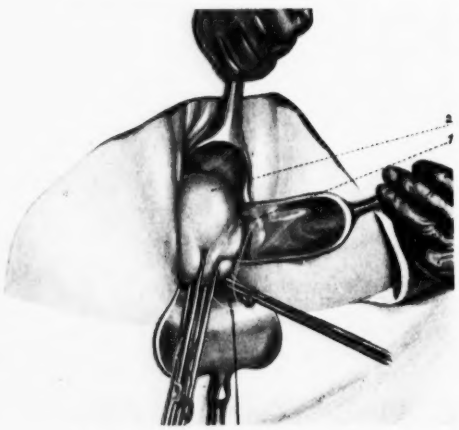


Fig. 5. It is made difficult in the presence of myomata to turn the uterus forward. *1*, Uterine end of the left tube; *2*, myoma in the posterior wall of the uterus.

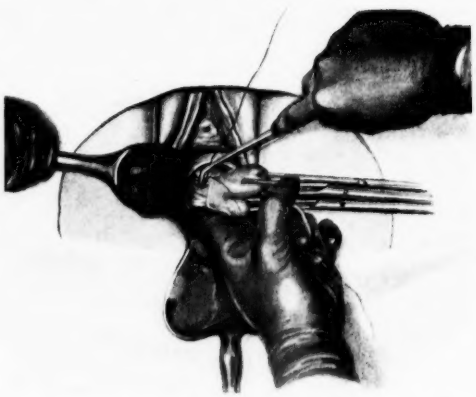


Fig. 4. The lower half of the parametrium, arched forward by the finger, is being tied off.

and can open the peritoneum between the two toothed forceps by a transverse cut and prolong the incision to both sides (Fig. 3). The upper cut edge of the peritoneum is at once fixed by means of a catgut suture to the anterior cut edge of the vagina, as otherwise it might slip back and there might arise difficulty in finding it. Then follows the opening of the posterior pouch of Douglas. The first assistant pulls with the right hand the tenacula holding the cervix in an upward direction toward the symphysis. The operator grasps with forceps the posterior vaginal wall below the transverse incision, draws it from the uterus, and cuts deepening the vaginal incision toward the cervix. This generally opens the peritoneum with the first cut of the scissors. The posterior flap of the peritoneum is at once sutured to the posterior edge of the vagina.

Step 3. Tying off the parametria. We generally begin with the right hand side. The first assistant pulls the cervix strongly to the left, the second assistant holds with his right hand the posterior retractor, while his left hand inserts an anterior retractor into the right lateral fornix. This proceeding makes the parametria accessible. When the parametria are tied off and separated, care must be taken to keep the ligated stumps long enough so as to prevent ligatures from slipping off and causing hæmorrhage. It is done in the following way: the operator enters his left index finger through the wound of the posterior colpocœliotomy into the pouch of Douglas and places his finger close to the cervix under the parametria. By bending his finger he arches the tissue toward himself and so makes it more accessible (Fig. 4). With a Deschamp's needle threaded with catgut

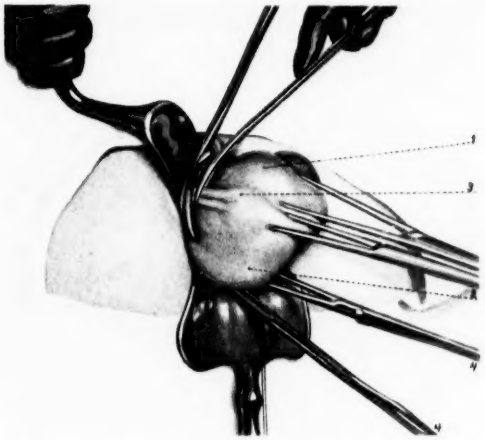


Fig. 6. The uterus is turned forward. The cervix is hidden by a myoma of the anterior wall of the uterus. *1*, Myoma of the posterior wall of the uterus; *2*, myoma of the anterior wall; *3*, uterine end of the right tube; *4*, tenacula inserted into the cervix.

or silk according to one's preference, portions of the tissue lying on the finger, usually half at a time, are successively sutured and ligated. The following proceeding of the first assistant is recommended in order to fix the knot sufficiently far away from the cervix to get a long stump, and on the other hand to be able to tie it as firmly as possible. He pulls the cervix as already mentioned as far aside as possible. Thereby the parametrium is stretched, and the knot can be placed well to the lateral side. As soon as the first knot is tied the traction of the tenacula must be loosened in order to make the knot tighter in the slackened tissue and to add the second and third tie. Only when all knots are tied, the cervix is pulled upon again, and the stretched tissue cut with scissors close to the cervix. The third ligature thus tied generally contains the uterine vessels. As soon as the uterine vessels have been tied off, the cervix is pulled to the other side and the left parametrium is detached and ligated in the same way. When both parametria are cut off, the cervix is pulled down in the median line and an anterior retractor is inserted below the bladder into the wound of the cœliotomy.

Step 4. The operator moves the tenacula up the freed anterior wall of the uterus to the fundus, which he rolls forward into the vagina through traction on the tenacula (Fig. 5). It is advisable to leave one tenaculum attached to the cervix so as to be able, after manipulation of the uterus, to draw the cervix, which in the meantime has

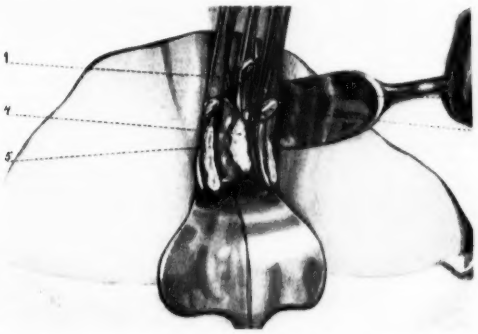


Fig. 7. The uterus is free. *1*, Clamp of the right adnexa; *2* and *3*, clamps of the left adnexa; *4*, ovary; and *5*, tube of the right side seen between the clamps.

slipped back, out of the vulva. This makes the amputation of the uterus much easier. Now the whole uterus is outside the vulva and attached only by the adnexa on both sides (Fig. 6).

Step 5. Separation of the uterus from the adnexa. One generally begins again on the right hand side. The first assistant pulls the tenacula holding the cervix and the corpus to the left hand side producing tension on the pedicle of the adnexa. The second assistant inserts the anterior retractor into the right lateral fornix thus making the adnexa more accessible. Small curved clamps of a similar shape to those used in Wertheim's operation, but much shorter, are attached beginning above with the tube and working downward, and the tissue is cut close to the uterus. Generally two to three clamps are sufficient. When the pedicles of the adnexa are detached, the

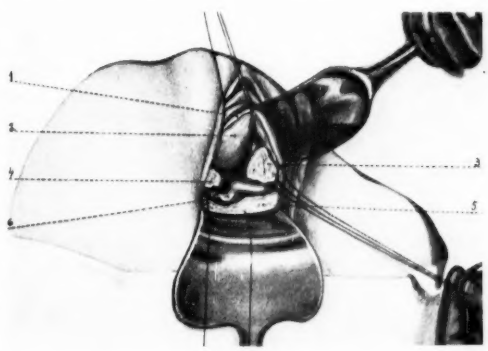


Fig. 8. Fixation of the stumps on the vaginal edge. *1*, anterior vaginal edge; *2*, peritoneum of the bladder; *3*, stump of the left adnexa; *4*, stump of the right adnexa; *5*, posterior vaginal edge; and *6*, right tube.

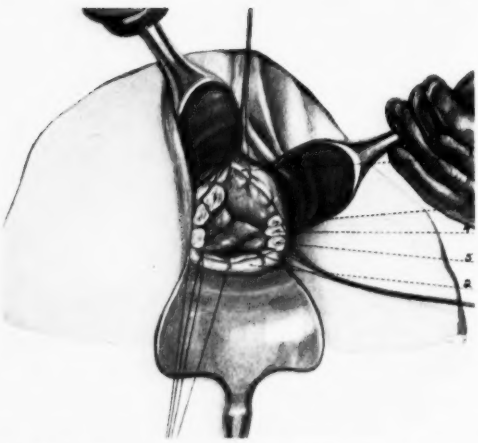


Fig. 9. The stumps in fixation. *1*, anterior edge of vagina and peritoneum of the bladder; *2*, posterior edge of vagina and peritoneum of rectum; *3*, stump of the left tube; *4* and *5*, stumps of the left parametrium.

uterus is free (Fig. 7). The clamps are replaced by ligatures.

Step 6. Toilet of the stumps. The fixation of the peritoneum of the bladder and of the rectum to the wall of the vagina which was done at the beginning of the operation with one ligature is completed by adding two more sutures both in front and behind. Then the stumps of the adnexa are sutured to the edge of the vagina (Fig. 8) and lastly also the stumps of the parametria. This leaves an opening leading from the vaginal cavity into the peritoneal cavity, which is edged all round with peritoneum (Fig. 9).

Step 7. Finally the peritoneal cavity is closed with a pursestring suture beginning at the peritoneum of Douglas's pouch, including the right stumps, then the peritoneum of the bladder, and lastly the left stumps. When catching up the stumps one should use care to include only very little tissue with the needle as otherwise there is a risk of hæmorrhage from a damaged vessel. When the pursestring suture is tied the peritoneum is closed (Fig. 10).

The closing of the peritoneum is not necessary to prevent a prolapse of the bowels. This would not occur even if the peritoneal cavity were left wide open and only a strip of gauze inserted. In such a case the remaining adnexa alone might be drawn into the vagina when the strip of gauze is removed. The advantage of closing the peritoneum after fixation of the stumps is that, first, in the abdominal cavity all is smooth and no

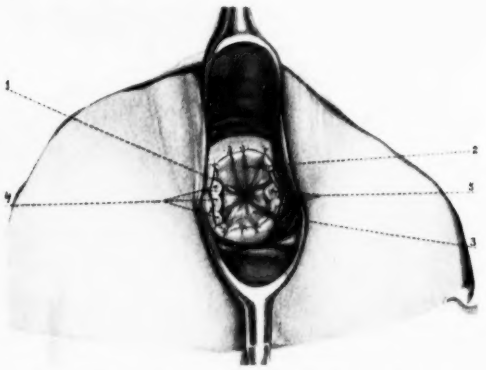


Fig. 10. The peritoneum is closed. *1*, Pursestring suture; *2*, peritoneum of bladder; *3*, peritoneum of Douglas's pouch; *4*, right stumps, and *5*, left stumps.

rough area is left, and, second, all stumps are directed into the vagina. Should there occur a delayed hæmorrhage, the blood cannot penetrate the peritoneal cavity and thus be concealed, but it appears at once in the vagina, and flows out of the vulva. At the end of the operation a strip of odoform gauze is placed in the vagina.

AFTER-TREATMENT

The after-treatment is very simple. The strip of gauze is removed on the next day. On the second day after the operation, an enema produces an action of the bowels, which, after a vaginal operation, is always much easier than after a laparotomy, because the intestines have not been disturbed at all, and therefore they take up their functions more quickly. On the fourth or fifth day the patient may get up, and on the eighth or tenth day as a routine she leaves the hospital. Beginning on the sixth day, vaginal douches with a solution of potassium permanganate are given, and before the patient leaves the hospital she is examined on the table, the vagina opened with two retractors, and the healing of the stumps is controlled. If necessary the cleansing of the stumps can be accelerated by painting with iodine.

With operators who use silk for ligating the vessels it may happen that the patients complain of a discharge, or slight bleeding, even weeks or months after. In such cases the ligatures are shed toward the vagina and appear in the vaginal lumen, and the formation of granulation tissue follows. If this happens the ligature ought to be removed, and the granulation painted with silver nitrate stick.

FROM THE CLINIC OF THE CHICAGO LYING-IN HOSPITAL AND DISPENSARY

TECHNIQUE OF BREECH DELIVERY

EDWARD L. CORNELL, M.D., F.A.C.S., CHICAGO

BREECH presentations demand the greatest of obstetric skill in their management. Problems such as are seldom seen in cephalic presentations are usually present, and the mortality rate is much higher both as to fetus and mother.

In this article I shall confine myself to the technique and methods used to accomplish safe delivery for both mother and baby. No hard and fast routine may be prescribed for all cases of breech presentation; each patient must be considered individually and the proper procedure followed in her given case.

The primipara gives the obstetrician the greatest concern. In her labor usually lasts longer and consequently is more painful and distressing. Not infrequently she becomes exhausted before the second stage of labor begins.

Since the breech is a poor dilator of the cervix, the obstetrician should endeavor to preserve the bag of waters as long as possible. If the membranes should rupture early, dilatation is prolonged and there is danger of prolapse of the cord. The latter condition is not uncommon. If the cervix is less than half dilated and the patient is not progressing, it is our practice in nearly all primiparæ and many multiparæ to use a Voorhees bag to hasten dilatation and to prevent prolapse of the cord. A pound or a pound and a half weight is attached to the bag. The patient is examined rectally immediately the bag is expelled to determine whether or not the breech fills the cervix and if there is a prolapse of the cord. If the cord is prolapsed, the patient is immediately transferred to the operating table and placed in deep Trendelenburg or the knee-chest position until she can be prepared for examination. A vaginal examination is then made and the cord replaced over an arm, if possible, or it is put in a position in which pressure is least likely to compress it during a labor pain.

If possible, the bag is not allowed to be expelled from the vagina. As soon as it is out of the cervix, the patient is placed in the knee-chest or Trendelenburg position, the water let out of the bag, and the bag removed from the vagina. After a pain or two the patient is allowed to assume the recumbent position and a rectal examination is made. The fetal heart tones are also checked.

If the cord prolapses in spite of efforts at replacement and the cervix is not completely dilated, a foot may be brought down and the cord placed above the hip. The leg is held down by light traction by the attendant during a few pains. One should never attempt to deliver the child through an undilated cervix. The baby will be lost or badly damaged in most instances and the maternal soft parts will be lacerated.

During the first stage, which is the most trying one to the patient and physician, some form of analgesia should be prescribed. We have found 1/6 to 1/4 grain of morphine sulphate to be very satisfactory. We combine it with 2 cubic centimeters of magnesium sulphate or 1/100 grain scopolamine. In some cases, especially primiparæ, the Gwathmey technique is employed. The results are usually gratifying although the patient as a rule does not deliver herself.

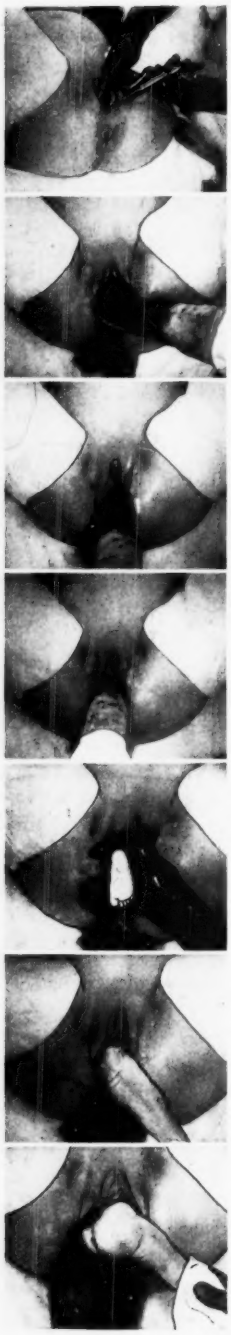
When the second stage of labor begins the patient will need the full use of the abdominal muscles and she should be out of the state of analgesia so she will be able to co-ordinate the bearing down effort with the pain. The breech does not dilate the perineum and vaginal orifice as readily as the head does; therefore, this stage is usually longer in duration and requires greater effort on the part of the mother.

In all breech cases, whether we expect them to deliver spontaneously or not, a full set of instruments should be laid out. This consists of the normal labor set, the perineorrhaphy and the forceps sets. The craniotomy set is held in readiness but is not sterilized unless required.

The patient is prepared in the manner described in a previous article on "Forceps Delivery."[1] The bladder and rectum should be emptied. She is never delivered on an ordinary labor bed, even if we expect the child to be born spontaneously, since delivery of the shoulders and head may be delayed. The time consumed in changing the position of the patient may endanger the baby in spite of the assertion of Potter that 20 minutes or more may be taken in the delivery of the shoulders and head.

After the patient has been draped the procedure varies with the course of labor. In spontaneous deliveries the anæsthetist gives ethylene

Surg., Gynec. & Obst., 1927, xxxvi, 221.



during the course of the pains to the point of analgesia only. The patient bears down and pulls on the straps attached to the sides of the divided labor bed or to the operating table.

In expert hands ethylene has been a very satisfactory general anæsthetic for labor cases. The anæsthetic machine should be properly grounded and also connected to the patient by means of a metal plate in contact with her body. One should not use any machine which permits gas to pass into an empty cylinder, which may cause an explosion as recently occurred. Our attitude toward ethylene has changed since the article on forceps mentioned was written. Combined with oxygen, ethylene can be given safely and the tissues will not bleed excessively. Ethylene is especially valuable in breech deliveries but it requires the services of a trained anæsthetist.

In full-term primiparæ and all multiparæ previously delivered by us, we do a deep mediolateral episiotomy as soon as the anterior hip is well exposed, i.e., when the vulva is dilated about 3 to 4 centimeters. For performing the episiotomy we use a light ethylene gas anæsthesia, thus allowing the patient to regain consciousness immediately. If we wish the patient to deliver the head promptly we must not give an anæsthetic to the point where she is unco-operative. We make it a rule that a patient must either be lightly under the anæsthetic or must be sound asleep. In the latter case, of course, we deliver the child by breech extraction or manual aid.

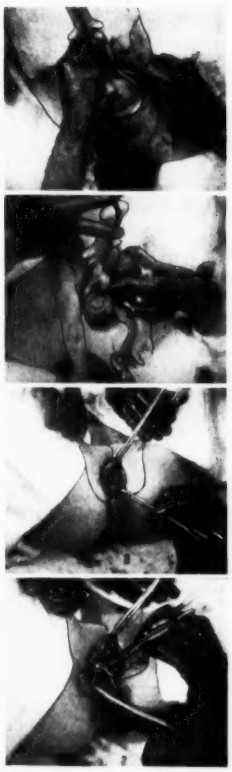
If the patient is not able to deliver herself or if delivery is delayed, the obstetrician should render manual aid. The breech may be lifted over the perineum by gentle traction in a downward and outward direction until the anterior hip is well under the pubis. The direction is then changed to an upward and outward pull. This assistance may be given during a labor pain. The anæsthetic is given only to the analgesic state. The patient then can usually deliver the shoulders and may be able to deliver the head also. If not, the patient is anæsthetized and one may gently insert the left hand into the vagina and deliver the head, the Smellie-Veit maneuver being used.

If, in the second stage of labor, the patient is unruly or will not co-operate, the obstetrician should not hesitate to give ethylene or ethylene and ether. The anæsthetic should be pushed until complete anæsthesia is obtained. In breech extraction the muscles of the abdomen and uterus should be thoroughly relaxed. The bladder should be emptied by catheter. The perineum is then ironed out carefully so that the rectum is thoroughly emptied of its contents. It is very difficult

to prevent the gloves from becoming contaminated by fæces in extracting the breech; therefore this point should be thoroughly emphasized.

The operator's hand, the palm of which points to the baby's abdomen, is inserted into the vagina and the anterior foot is sought in those cases in which the breech is low in the pelvis. If both feet are down in the pelvis, then both are grasped after the legs are straightened out, or one foot at a time may be extracted, but no traction should be used so as to displace the hips. After the feet are born, traction is made in a downward and outward direction until the anterior hip presents under the pubis. It is then time to perform the episiotomy. Personally the author performs it on the left side in all cases. Many obstetricians prefer to cut the side through which the occiput will come; i.e., in left presentations they do the episiotomy on the left side while in right presentations they cut the right side. The hæmorrhage is controlled by means of a gauze sponge placed in the wound until the hips pass over it.

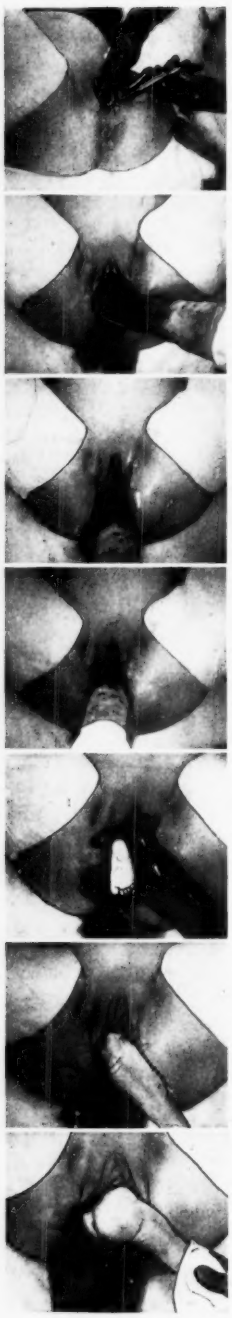
Traction is now continued in the same downward and outward direction until the anterior shoulder impinges under the pubis. No set rule is employed to deliver the arms. The anterior arm is usually brought down first. If, for any reason, it is difficult to extract it, the posterior arm is delivered first. Not infrequently this arm is born spontaneously. To deliver the posterior arm, the body of the baby is lifted upward gently and a hand is passed into the vagina over the deltoid muscle.



The baby's arm is passed across its chest and drawn down and out of the vagina. The body is carried down until the anterior shoulder is well exposed. Two fingers of operator's opposite hand are passed over deltoid muscle of baby's arm, and the arm is gently passed across the chest and delivered over the perineum. If the arms do not come out easily, Potter's maneuver may be used.

The delivery of the arms and shoulders in many cases causes considerable trouble. If the baby is large it is often desirable to vary the usual technique somewhat and bring down the arms to the baby's side before the shoulders appear at the vulva. The same holds true in cases in which the arms have become stripped beside the head or in the nape of the neck. If this latter abnormality in position has not been noted early and one has locked the arms in place, it is best to press the baby back an inch or more to loosen up the arms and to insert a hand and release the posterior arm first. The anterior arm can usually be delivered then without rotating the body so as to bring this arm posterior. If not, the baby's body should be rotated so as to bring the arm into the hollow of the sacrum. The position of the head should be carefully determined before extraction since not infrequently the head does not rotate with the back. In this case the back must be returned to its original position.

The most important and the most difficult part of the delivery is the birth of the head. If the mechanism is understood, the delivery is usually relatively easy. In a normal sized pelvis with an ordinary sized baby, the head should be placed in one of the oblique diameters with the occiput pointing anteriorly. The operator's left hand is passed into the vagina and the baby's body is placed astride the arm. The first two fingers seek the baby's maxilla. The thumb is placed on the mandible and the last two fingers fall into place on the opposite side of the child's face. Occasionally it is necessary to place the first finger in the baby's mouth at this point in order to guide the head into position. I personally prefer the right oblique diameter. I endeavor to rotate the head to that diameter in all right position breech



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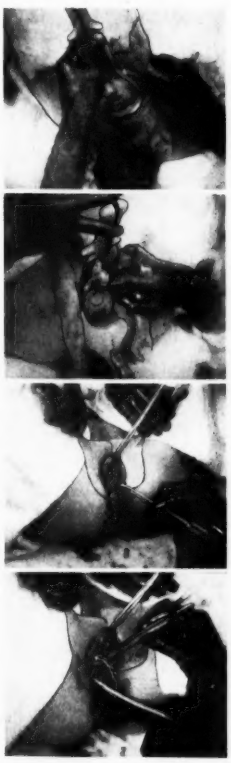

to prevent the gloves from becoming contaminated by fæces in extracting the breech; therefore this point should be thoroughly emphasized.

The operator's hand, the palm of which points to the baby's abdomen, is inserted into the vagina and the anterior foot is sought in those cases in which the breech is low in the pelvis. If both feet are down in the pelvis, then both are grasped after the legs are straightened out, or one foot at a time may be extracted, but no traction should be used so as to displace the hips. After the feet are born, traction is made in a downward and outward direction until the anterior hip presents under the pubis. It is then time to perform the episiotomy. Personally the author performs it on the left side in all cases. Many obstetricians prefer to cut the side through which the occiput will come; i.e., in left presentations they do the episiotomy on the left side while in right presentations they cut the right side. The hæmorrhage is controlled by means of a gauze sponge placed in the wound until the hips pass over it.

Traction is now continued in the same downward and outward direction until the anterior shoulder impinges under the pubis. No set rule is employed to deliver the arms. The anterior arm is usually brought down first. If, for any reason, it is difficult to extract it, the posterior arm is delivered first. Not infrequently this arm is born spontaneously. To deliver the posterior arm, the body of the baby is lifted upward gently and a hand is passed into the vagina over the deltoid muscle.

The baby's arm is passed across its chest and drawn down and out of the vagina. The body is carried down until the anterior shoulder is well exposed. Two fingers of operator's opposite hand are passed over deltoid muscle of baby's arm, and the arm is gently passed across the chest and delivered over the perineum. If the arms do not come out easily, Potter's maneuver may be used.

The delivery of the arms and shoulders in many cases causes considerable trouble. If the baby is large it is often desirable to vary the usual technique somewhat and bring down the arms to the baby's side before the shoulders appear at the vulva. The same holds true in cases in which the arms have become stripped beside the head or in the nape of the neck. If this latter abnormality in position has not been noted early and one has locked the arms in place, it is best to press the baby back an inch or more to loosen up the arms and to insert a hand and release the posterior arm first. The anterior arm can usually be delivered then without rotating the body so as to bring this arm posterior. If not, the baby's body should be rotated so as to bring the arm into the hollow of the sacrum. The position of the head should be carefully determined before extraction since not infrequently the head does not rotate with the back. In this case the back must be returned to its original position.

The most important and the most difficult part of the delivery is the birth of the head. If the mechanism is understood, the delivery is usually relatively easy. In a normal sized pelvis with an ordinary sized baby, the head should be placed in one of the oblique diameters with the occiput pointing anteriorly. The operator's left hand is passed into the vagina and the baby's body is placed astride the arm. The first two fingers seek the baby's maxilla. The thumb is placed on the mandible and the last two fingers fall into place on the opposite side of the child's face. Occasionally it is necessary to place the first finger in the baby's mouth at this point in order to guide the head into position. I personally prefer the right oblique diameter. I endeavor to rotate the head to that diameter in all right position breech

cases. This is done by gently pushing the head above the pelvic brim and rotating it anteriorly through an arc of 90 degrees. If the head does not rotate easily the attempt is abandoned and delivery is affected by means of the left oblique diameter.

After the head is placed in position (this is important), the operator's right hand is placed on the baby's neck, the first finger on the baby's left clavicle and the second finger on the right clavicle. Do not press on the neck structures; in other words do not squeeze the neck between the fingers; for pressure is apt to injure the brachial and cervical plexuses. The operator is now ready to deliver the head. He should be gentle and deliberate in all maneuvers at this point. It is here that the greatest damage is done to mother and baby. The mother may suffer a third degree laceration or a rupture of the lower uterine segment and the baby an Erb's paralysis, a fractured skull, broken neck, or a rupture of the tentorium cerebrii. Let me repeat, be gentle and deliberate in all maneuvers from this point onward.

With the head in proper position and the operator's hand properly placed, traction is made in a downward outward direction. The occiput is slowly brought anterior under the pubis. If difficulty is experienced in bringing it down, the right hand is placed on a sterile towel over the lower uterine segment above the pubis. The back of the closed fist is used to exert pressure on the head while the vaginally placed hand guides the head into and through the pelvis. Too much pressure should not be used in this maneuver, since one is liable to rupture the lower uterine segment or fracture the fetal skull. The head can usually be forced down onto the perineum without trouble. As the head comes down one should raise the body of the baby upward. Be careful not to bring the body up too fast as the neck may be injured in this manner. As soon as the mouth and nose appear the delivery of the rest of the head can be accomplished slowly since the baby can breathe without difficulty. Unless there is an indication for rapid delivery, five minutes is taken to pass the head over the perineum.

In a patient with a flat pelvis, the delivery of the head differs somewhat from the above description. In such cases the head should be placed in the transverse diameter and extended. This places the widest diameter of the head to one side of the conjugata vera. The head is guided into the pelvis and if the latter is not too contracted it can be passed in synclitism. If the pelvis is moderately contracted posterior asynclitism should be encouraged. By combined abdominal pressure over the pubis and traction from below with the operator's left hand, the posterior parietal bone is drawn over the sacral promontory. The anterior parietal bone can then be easily brought into the pelvic excavation. This accomplished, the occiput is rotated anteriorly and the delivery is effected as described in the last paragraph.

Occasionally difficulty is experienced in delivering the head within the prescribed time of 8 minutes. An assistant nurse is charged with the duty of calling out the minutes as the time passes. At the end of 6 or 6½ minutes, the forceps should be used if the head is not delivering or easily deliverable. We use the long Simpson forceps as modified by DeLee. If possible, the head is made to engage in one of the oblique diameters. The baby is lifted up so as to make room for the application of forceps to the sides of the aftercoming head. After the forceps are applied, gentle but firm traction is made in a downward and outward direction. The face usually comes down on the perineum without much trouble. If it does not, and the time is short, and the child makes several attempts to breathe a specially constructed wide single bladed speculum is inserted over the perineum. This is carried up to the child's mouth and nose, thus allowing it to breathe. After it has taken several breaths of air, traction is again made and the head delivered slowly. At this point the head should be controlled so the perineum is not stretched too quickly, thus avoiding tears. Plenty of time is taken to deliver the head since the child can breathe without interference. As soon as the biparietal diameter reaches the outlet, the forceps are removed, the right blade being released first. The head is then gently delivered over perineum.

The baby is placed in a sterile towel covered tray. This tray is carried on a small stand which is wheeled between the operator and the operating table. After the cord toilet is attended to, the baby on the stand is wheeled to the crib.

As soon as the head is born ½ or 1 cubic centimeter of pituitrin is given subcutaneously. This insures good uterine contraction and less hæmorrhage. The assistant's hand follows the uterus down without pressure or massage. As soon as the placenta leaves the body of the uterus, it is expressed the remaining distance by means of firm pressure on the well contracted body of the uterus. Never try early expression or pull on the cord to deliver unless the uterus is firmly contracted since inversion is apt to occur.

As soon as the placenta is delivered, a thorough inspection is made of the lower uterine

segment for tears and possible rupture of the uterus. This is done in all breech labors. Before the hand is inserted, the gloves should be changed and the perineum thoroughly washed with lysol solution. The vagina is opened by the insertion of the fingers palm side up, and about 1 ounce of 2 per cent mercurochrome or hexylresorcinal solution is poured into it. This is wiped over the vaginal canal in an attempt to help sterilize it. If no tears are located in the lower uterine segment, the hand is withdrawn and the special speculum previously mentioned is passed into the vagina and the cervix carefully inspected. It is repaired if necessary with interrupted 40 day chromicized No. 2 catgut.

Any lacerations of the vagina are repaired with interrupted catgut while the episiotomy wound is sewed with interrupted or continuous catgut or silkworm gut, depending on the operator or the liability of infection in the particular patient.

The description given is the usual technique used in the average case with a mild flat pelvis or a normal pelvis, when the patient is under control throughout labor. If the patient comes into the hospital after being in labor for a considerable time, variations are made to suit the exigencies of the case. All breech cases should be delivered in the hospital, never in the home unless help is plentiful.

Breech deliveries in markedly flattened pelves, in generally contracted and funnel pelves are formidable many times. In the latter type, if the outlet is much narrowed, we prefer cæsarean section before the patient goes into labor or at least shortly after labor begins.

VARIATIONS IN TECHNIQUE

In single breech presentation (where both feet are under the chin) with premature rupture of the membranes, the liquor well drained, the cervix completely dilated, and the patient exhausted, the physician may be forced to deliver the patient. If the breech is well down on the perineum, the extraction is not so difficult. If the breech is high and the uterus hugging the child tightly, it may be impossible to insert the hand into the uterus, to bend a leg and extract it. In such a case, the author has passed a catheter over the anterior groin and then attached a wide Mayo sponge to it. The catheter is withdrawn and the gauze placed over the child's leg as close to the groin as possible. The left hand is then placed in the vagina and the posterior groin is grasped. The right hand pulls on the gauze. In this manner the buttocks are brought down into the pelvis. As soon as the perineum begins to bulge a deep episiotomy is done. Then traction is continued until the fingers can be inserted beneath the anterior groin. Too much traction should not be used as the femur may be broken. O. Kustner[1] advises the use of a hook applied to the posterior hip for the same purpose. The gauze has the advantage that it is widely applied and is less apt to injure the bone or soft structures.

Wherever possible the legs of the patient should be held by assistants. This has many advantages over mechanical leg holders. In patients with flat pelves, the legs may be dropped into the Walcher position which may give sufficient room to deliver the head. Dropping the legs into the half Walcher relieves the pressure on the perineum thus rendering it less liable to tears.

CRANIOTOMY ON AFTERCOMING HEAD

In patients coming to delivery with dead babies or those in which the child is lost in an attempt at delivery, it is always best to do a craniotomy on the aftercoming head. In multipara one can often deliver the head easily without damaging the maternal soft parts. A craniotomy may be done through the roof of the mouth or through the occiput. In the former case the body of the baby is lifted well up over the mother's abdomen. The lower jaw is brought down as far as possible and a Naegele perforator is pushed through the hard palate. The opening is enlarged by twisting the perforator or by inserting it in several directions.

The brain tissue is broken up by long forceps or the irrigator point. It is irrigated out of the skull by a metal irrigating point plain sterile water being used. The center piece of the cranioclast is inserted. Then the two lateral blades are attached and the fetal head extracted in the usual manner. Care should be used that the exposed spicules of bone do not injure the maternal soft parts. After the fetus is removed the entire uterine cavity should be thoroughly examined for lacerations; if any are found they should be immediately repaired.

[1] Monatsch. f Geburtsh. u. Gynaek., 1928, April.

OPERATIVE TECHNIQUE OF PHRENIC NERVE INTERRUPTION[1]

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TEMPORARY or permanent paralysis of one-half of the diaphragm by operation on the phrenic nerve has gained a permanent place in therapeutics. Indications for its use and its distinct limitations have been widely discussed in current journals. This article is limited to presentation of a simple operative technique that has been extensively used in this clinic without any mishap.

Identification of the nerves deep in the base of the neck occasionally is very difficult, especially when their arrangement is abnormal. Study of Figure 1 reveals what vital structures are in jeopardy. In spite of frequently heard statements to the contrary the operation may prove dangerous and even fatal in either execution or effect. The vagus, long thoracic, and sympathetic nerves by mistake have been cut, the brachial plexus has been wounded, the thoracic duct torn, the dome of the pleura opened, and large arteries and veins wounded. Surely the operation should not be undertaken by anyone untrained in general surgery.

Breakfast is withheld. One half hour before operation adults are given a hypodermic of 0.01 gram of morphine sulphate, but no atropine. The patient lies on his side on the operating table, with a pillow beneath the head to keep the neck in line with the trunk. When the patient lies on his back the omohyoid muscle assumes a higher position and makes approach to the phrenic nerve above the muscle relatively difficult. Approach below rather than above the muscle requires a deeper dissection and in closer proximity to the thoracic duct and other structures desirable to avoid.

Stainless Harrington's solution or alcohol is painted upon the skin which was cleaned and, if necessary, shaved the previous evening. Drapes are placed so as to leave exposed only the lower few inches of the sternocleidomastoid muscle and posterior cervical triangle. The surgeon stands behind the patient, the assistant in front.

The anterior end of the proposed incision begins at the posterior border of the sternocleidomastoid muscle where it is crossed by that oblique skin crease which appears, or is made apparent, by flexing the head laterally, from 2 to 4 centimeters above the clavicle. It is important that the furrow posterior to the sternal tendon of the sternocleidomastoid be not mistaken for the far less evident furrow behind the clavicular fibers. The latter may be made apparent by having the patient raise his head anterolaterally against the resistance of a nurse's hand placed on his forehead as illustrated in Figure 2. A fine hypodermic needle is made to pierce the skin at the anterior end of the proposed incision and this one puncture mark serves to identify the point after the muscle is relaxed and the local anæsthetic has been injected. From 10 to 15 cubic centimeters of ½ per cent of procaine is injected intradermally and into the superficial tissues.

The incision need not be longer than 2 centimeters in the case of thin persons; in others rarely more than 4 centimeters. The skin, subcutaneous fat, and platysma muscle are opened in this order. Small towels are sewed to the subcutaneous tissue to exclude skin organisms from the wound. Beneath the platysma and the superficial layer of the deep cervical fascia, the external jugular vein sometimes crosses the wound and may be either divided or retracted. Next in depth the superficial layer of the deep cervical fascia is incised. Beneath it is an always thick layer of fat in which one or two descending sensory branches of the cervical plexus are usually met; these are directly infiltrated with procaine and retracted, or perhaps divided. In this fat may also be met lymph nodes and the large superficial and transverse cervical arteries and veins. On their account it is well to divide this fat bluntly with scissors. Satisfactory retractors are pictured in Figure 7. The mesial retractor may so flatten and empty an abnormally posteriorly placed internal jugular vein that it may appear as a strip of fascia and might innocently be cut.

Deep to the fat is the rather dense prevertebral fascia which immediately covers the scalene muscles, the phrenic nerve, and brachial plexus. These structures are only indistinctly visible through this fascia (Fig. 4) which must be incised in order certainly to identify them.

The brachial plexus, which term is used loosely to designate the anterior primary divisions of the cervical nerves, is the best guide to the phrenic nerve. The plexus passes inferiorly and slightly laterally between the scalenus anticus and medius muscles. Only rarely is it necessary to separate these muscles in order to see it. Mesial to it and posterior to the sternocleidomastoid is the scalenus anticus, at the inner edge of which may be

[1] From the Department of Surgery, University of Michigan Medical School.

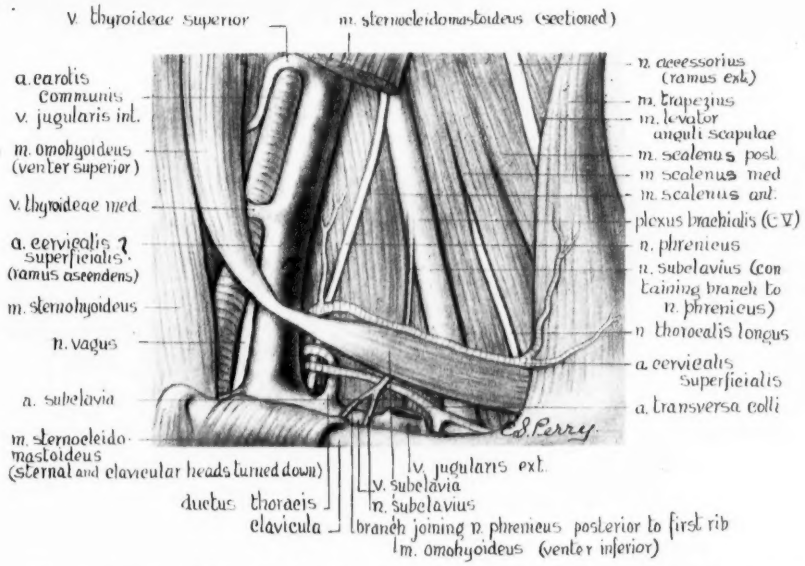

Fig. 1. Anatomy of base of left neck. Sternocleidomastoid divided and turned down. All but lowest end of external jugular vein removed.

felt the tips of the transverse processes of the cervical vertebræ. The phrenic nerve springs from the third, fourth, and fifth cervical roots and passes inferiorly and mesially on the anterior surface of the scalenus anticus. When the incised prevertebral fascia is retracted, the phrenic nerve may cling to its posterior surface and not be seen on the scalene. The phrenic nerve and the small nerve to the subclavius are the only nerves coming from the brachial plexus and lying between the prevertebral fascia and scalenus anticus muscle, that have a mesial inclination. One or two of the descending sensory branches of the cervical plexus incline mesially, but they are in the fat anterior to the prevertebral fascia. The sympathetic trunk and vagus nerve are vertical and nearer the midline of the neck. The long thoracic nerve emerges from among the fibers of the scalenus medius and descends laterally on it.

The nerve to the subclavius frequently contains phrenic fibers that leave this nerve very low in the neck as the so-called principal accessory phrenic nerve and join the main phrenic trunk within the thorax. The nerve to the subclavius usually leaves the anteromesial or mesial surface of the brachial plexus low in the operative field and in a large majority of cases may be identified. If not visible without dissection, it may be searched for between the plexus and scalenus anticus by grasping the epineurium of the fifth cervical root and rotating this with much gentleness. Not infrequent abnormalities[1] in the anatomy of the main and accessory phrenic nerves may greatly complicate the operation.

[1]Plenk, Andreas, and Matson, Ralph C. Zur Phrenicotomiefrage Beitr. z. Klin. d. Tuberk., 1925, lxii, 350–355.
Goetze, Otto. Die effektive Blokage des Nervus phrenicus. Muenchen. med. Wchnschr., 1925, lxxii, 1110–1113.

Fig. 2. Position of incision in skin crease. Posterior border of sternocleidomastoid accentuated by raising head anterolaterally against resistance. Prick of local anæsthetic needle marks anterior end of proposed incision.

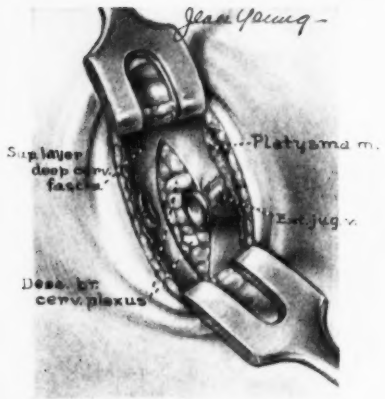

Fig. 3. Superficial tissues divided. Exposure of descending sensory branches of cervical plexus in thick fat layer.

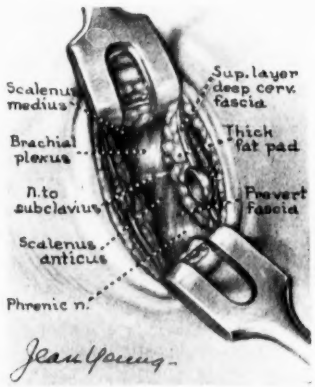

Fig. 4. Exposure of prevertebral fascia with underlying structures indistinctly visible.

Crushing or excising a portion of only the main phrenic trunk cannot be relied upon to cause total hemidiaphragmatic paralysis. The accessory phrenic nerve must also be treated. Permanent total paralysis or phrenicectomy may be obtained in either of two ways:

1. *Exeresis or evulsion.* Exeresis or evulsion of the main phrenic trunk at the same time ruptures any accessory nerve fibers that may have entered the main trunk. This is first directly infiltrated with procaine and divided proximal to a hæmostat or, better, Oscar Proctor's special forceps (Fig. 5). Then by steady, not jerky, traction the nerve is very slowly rolled around the instrument, care being taken that the nerve be kept clean from clinging connective tissue that might, if evulsed, cause rupture of the pericardiacophrenic vessels. If evulsing the nerve causes severe pain in the neck, shoulder, thorax, or abdomen, several moments of gas analgesia should be given. If not fewer than 12 centimeters of the nerve are evulsed before rupture, it is reasonably certain that the accessory phrenic has been disconnected from the diaphragm.

2. *Partial excision of both main and accessory (n. to subclavius) trunks.* After both trunks are directly infiltrated, 2 or 3 centimeters of each is excised, after the distal ends are freed from their

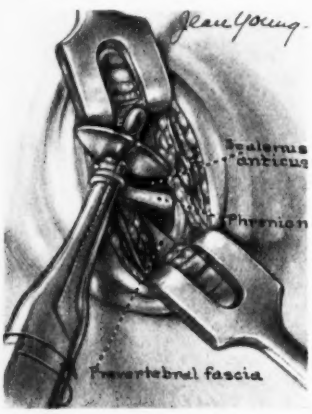

Fig. 5. Prevertebral fascia incised. Main phrenic nerve divided and distal portion being evulsed with Proctor's forceps.

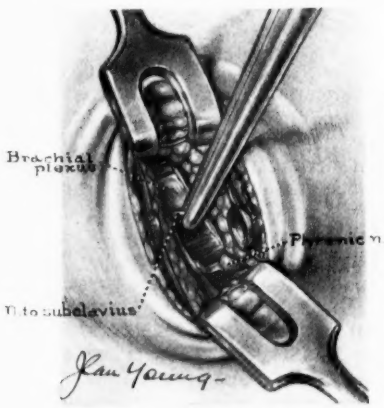

Fig. 6. Temporary phrenic nerve paralysis. Main phrenic trunk has been thoroughly crushed with hæmostat and nerve to the subclavius is being crushed.

surroundings as far inferiorly as safely possible in order to rupture sympathetic filaments from the suprapleural sympathetic plexus that may have some motor function. Obviously, if more than one accessory phrenic trunk exists, all must be severed. In one case I found five phrenic trunks; in another, four.

Temporary total paralysis of the diaphragm, which persists 3 or 4 months, is best obtained by thoroughly crushing the main phrenic trunk with a hæmostat and either crushing or excising a portion of the accessory phrenic (Fig. 6).

Knowledge of whether or not total diaphragmatic paralysis has been accomplished is most surely obtained through the fluoroscope. Total paralysis leaves the paralyzed hemidiaphragm in position of full expiration and, as the patient sniffs, the paralyzed half rises and the unparalyzed half descends. This upward movement on sniffing or deep inspiration is paradoxical respiratory movement. If a fluoroscope be not available in the operating room, percussion of the height of the hemidiaphragm and of its ability to move on deep respiration offers a usually accurate test of the completeness of the operation.

In closing the wound the only sutures used are two or three of catgut in the platysma and one continuous intracuticular mattress suture of "dermal" or horsehair (Fig. 7). If knots are tied at the ends of the cutaneous suture they should be at least 1 centimeter from the skin to prevent their being buried as a result of postoperative swelling of the wound. No drainage is used. The intracuticular suture is removed in 5 days. Lymphœdema may keep the wound indurated for several weeks. The scar after the operation is usually inconspicuous.

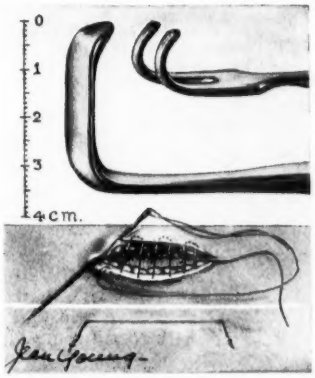

Fig. 7. The longer retractor is useful to obtain extensive exposure deep in wound. Intracuticular suture enters and emerges at very edge of cut skin. Suture ends have been pulled to close wound and knots tied at a distance from skin.

THE ADVANTAGES OF TWO-STAGE CHOLECYSTENTEROSTOMY[1]

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THE operation of cholecystenterostomy has justified itself in the relief of obstructive jaundice due to pancreatic obstruction of the common bile-duct. If the only result of the operation was relief of jaundice and the termination of the severe and constant itching of which these patients complain so bitterly, it would be worth the operative ri k. The risk of the operation is still further justified when one is able to give these patients the benefit of exploration of the biliary passages which not infrequently but unexpectedly reveals a stone in the common duct which has produced jaundice without pain. After cholecystenterostomy, if the lesion in the head of the pancreas is an inflammatory one, the patient continues to be well, and if malignant, although he eventually succumbs as a result of the condition, the interval between operation and death becomes a comfortable one.

During the last 4 years, I have performed cholecystenterostomy for the relief of jaundice due to obstruction of the pancreatic portion of the common bile duct on 15 patients. Ten of these are living and free from jaundice and itching. Two patients died at home, 19 and 20 months, respectively, following operation. These patients were free from jaundice and itching and worked until a few weeks before death.

Occasion recently presented itself to re-examine one of these patients on whom cholecystgastrostomy was performed January 5, 1925, for the relief of jaundice due to a pancreatic tumor. The postoperative course of this patient was without incident. Successive examinations subsequent to operation and reports from the patient by letter can be summarized as follows: November 12, 1927, the general condition was satisfactory; he had gained 20 pounds in weight and had slight diarrhœa. February 27, 1928, he complained of gas and epigastric pain at night. The stools were more nearly normal than in the previous year and his general condition was satisfactory. In December, 1928, he began to have more severe epigastric pain and an occasional attack of vomiting. He returned for examination January 10, 1929, at which time he showed loss of weight. Roentgenographic examination disclosed an abdominal tumor extrinsic to the lower third of the stomach, compressing it sufficiently to produce gastric stasis. Apparently the patient is on a downward course, yet he has lived nearly 4 years comfortably.

The risk of cholecystgastrostomy has been due to two factors: the tendency to bleeding as a result of severe jaundice and renal and hepatic insufficiency occurring subsequent to operation.

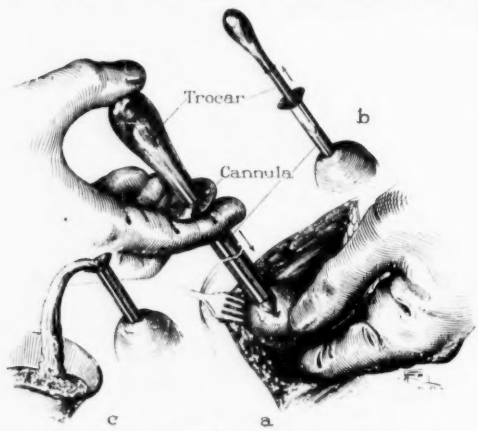


Fig. 1. Puncture of the gall bladder to release bile.

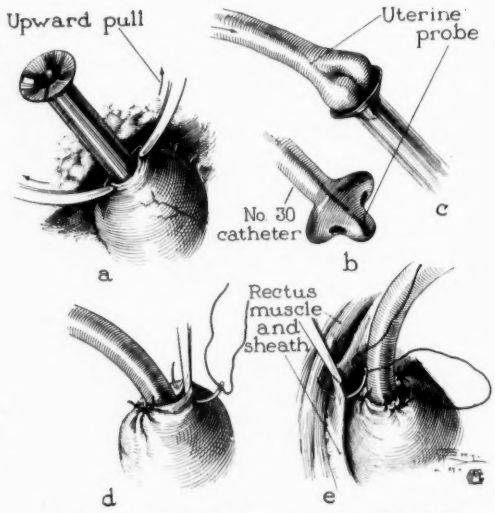


Fig. 2. Pezzar catheter placed in the gall bladder.

[1]Submitted for publication February 15, 1929.

Of 12 cases in which the suture method of anastomosis used was one which gave every evidence of prevention of bleeding from the edges of the anastomosis, there was one case in which death occurred from postoperative intravisceral hæmorrhage.

A reasonable working hypothesis would seem to be that if the jaundice could be lessened before the anastomosis is made between the gall bladder and stomach or duodenum, the risk of the operation would be lessened, not alone from the decrease in the tendency to bleeding but also from the lessened chance that precipitation of hepatic or renal insufficiency might occur. To accomplish the decrease in jaundice, external drainage of the gall bladder became a necessity. Realizing that these patients after cholecystostomy lose a tremendous amount of fluid from the tissues of the body, discharged through the biliary tract, and in many instances die from this loss of fluid in a comparatively short time, I believed that anastomosis between the gall bladder and stomach or duodenum should be made and the operation completed approximately on the twelfth or fourteenth day following cholecystostomy to prevent dehydration toxæmia. This two-stage operation has now been used in[1] 3 cases with very satisfactory results.

A No. 30 Pezzar catheter is inserted into the gall bladder through a trocar as one would insert a similar catheter into the distended urinary bladder, the gall bladder having first been exposed through a small abdominal incision made directly over it. This can be done under local infiltration anæsthesia of the abdominal wall (Fig. 1). By pulling the Pezzar catheter up so that it fits snugly about the edges of the opening in the gall bladder and fastening it in this position, bleeding is prevented, due to compression (Fig. 2). Gradual decompression of the biliary tract, as suggested by Crile, is done, allowing biliary drainage through the tube for 15 minutes every hour until the biliary passages have decompressed themselves.

Twelve or fourteen days later, under local infiltration anæsthesia in the abdominal wall with the incision made slightly to the inner side of the preceding one, the abdomen is opened, the gall bladder dissected from the abdominal wall, and the lighter end of a Murphy button placed in and maintained there by a pursestring suture or by silk. The site of the anastomosis to the stomach or duodenum is dependent on which one of these structures can be best approximated to the gall bladder without undue tension (Fig. 3). In two or three instances, the duodenum has been used, which I believe is more satisfactory than the stomach. It seems that the anastomosis of the gall bladder to the stomach apparently produces in the first few days following operation interference to motility in the latter to the extent that gastric retention more often occurs than if the duodenum is chosen as the site of the gall bladder anastomosis. A Murphy button type of anastomosis has been chosen, not with any idea of originality, for its use in this anastomosis was suggested and used many years ago by Murphy, Mayo, Mayo-Robson and others, but because in the anastomosis the cut edges of the gall bladder and stomach or duodenum are prevented from bleeding by the compression which exists when the ends of the Murphy button are placed in contact. It has the additional advantage of maintaining an absolutely constant lumen to the anastomosis regardless of any infection, swelling, or œdema which may take place about it. In both respects, I believe it has an advantage over the suture method. In one or two instances, following a suture type of cholecystenterostomy I have felt certain that the cause of unusually severe postoperative reaction was due to swelling or œdema occurring at the point of anastomosis, producing incomplete biliary obstruction, which, in such jaundiced patients, is nearly always fatal.

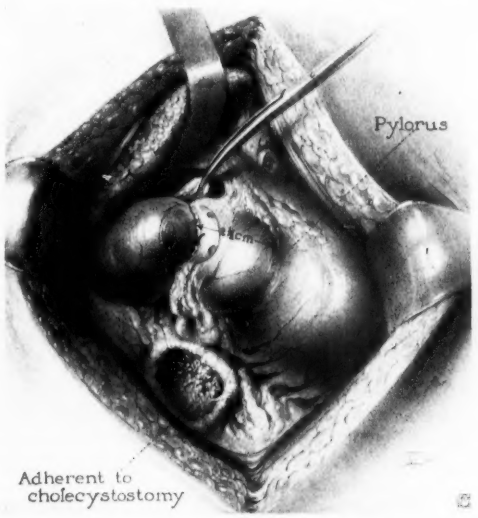


Fig. 3. Cholecystduodenostomy suture in the anterior wall of the duodenum and gall bladder.

[1] From February 15, 1929, to July 4, 1929, the two stage method has been used on 4 additional cases, making a total of 7 cases in which the results are excellent.

A MANOMETRIC METHOD FOR THE DETERMINATION OF THE LEVEL OF A SPINAL SUBARACHNOID SPACE BLOCK[1]

LOYAL DAVIS, M.D., F.A.C.S., AND LEWIS J. POLLOCK, M.D., CHICAGO

IT is a familiar fact that if water is poured into a number of connected tubes, the surfaces of the liquid in the various tubes will lie in the same horizontal plane. If an additional amount of water is poured into one of these tubes, the fluid level will rise the same distance in each tube. The successive additions of similar amounts of water will be followed by a rise in fluid level of the same distance. However, if one of the tubes is sealed at any given level, the introduction of any amount of water will be followed by an increased rise of the fluid level in the two unsealed tubes. This obvious fact can be utilized in the determination of the level of a complete block in the spinal subarachnoid space.

If one of three rigid tubes is sealed before any fluid is introduced, the liquid will rise then only in the two unobstructed tubes. This follows because the pressure against which the fluid has to rise is far less than in the sealed tube where the air must be compressed. However, if the tubes are filled with liquid, and two of them are sealed at higher levels than the third, and then, if the fluid is removed and reintroduced, the failure of filling may be obviated. Similarly, if the third tube is not a rigid tube the fluid will rise in it as well as in the remaining two. Weed[2] has shown that the spinal dural sac is not a rigid tube but can collapse inwardly. Therefore, it lends itself to the study of the above hydrodynamic principle.

With these facts in mind a model was constructed (Fig. 1). A glass manometer tube calibrated in centimeters was attached to one of the arms of a Y-glass tube by means of one inch of rubber tubing. The other arm was attached to a soft rubber slip cover for a Kollmann urethral dilator. To the straight arm, a T-tube was attached by one inch of rubber tubing after the interposition of a valve which permitted a flow of fluid only in the direction of the manometer. A long rubber tubing was attached to one of the arms of this T-tube. Its free end was submerged in a bowl of water. In the course of this piece of tubing a valve was placed which allowed the fluid to pass only from the bowl to the manometer. To the other branch a one cubic centimeter syringe was attached. It will be seen that successive injections of 1 cubic centimeter of water could be made continuously by aspirating the fluid from the bowl and forcing it into the manometer and slip cover at the same time. After the rubber slip cover was stripped of air, the system was filled with water and all bubbles of air removed. The water was allowed to flow out until a level in the manometer was reached which was designated as zero. A ligature was applied around the rubber slip cover and water injected in amounts of 1 cubic centimeter at a time. At the end of each injection, the height of the fluid level was read off on the manometer. Before the level of the ligature was reached, each injection of 1 cubic centimeter of water was followed by a rise of level of the water in the manometer which was fairly constant. When the level of the ligature was reached the next injection of 1 cubic centimeter of water would be followed by a rise of the level of the water in the manometer which was critically greater in height. This was tried repeatedly at different levels upon a considerable number of occasions. The readings may be illustrated by the following figures. The figures in the upper line represent the manometer before the height of each successive rise, and the figures in the lower line represent the amount of each rise.

4.65	4.5	4.35	4.2	4.05	3.9	3.8	3.2	2.65	2.0
.0	.15	.15	.15	.15	.15	.10	.6	.85	.65

The critical rise in this instance was between 3.8 and 3.2 centimeters. This figure was then corrected to a more accurate localization by bracketing it. Starting at 4.2 the figures were as follows:

4.2	4.05	3.9	3.65	3.2	2.6	2.0	1.4	.8
.0	.15	.15	.25	.45	.6	.6	.6	.6

The level of the ligature was at 3.65 centimeters, and the experiment accurately localized it. In this experiment a burette calibrated in tenths of a cubic centimeter by volume was used. Each 1/10 of a cubic centimeter was equal to 1 centimeter in distance. The same experiment was repeated upon a cadaver in which a ligature was placed about the spinal dura mater at the level of the fourth dorsal vertebra. The results were identical.

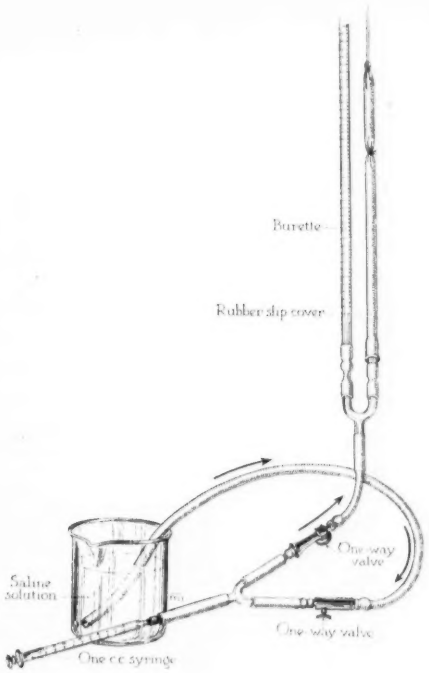
An opportunity to use the method presented itself to us in 2 cases. In 1 case, in which a compression was localized at the level of the spine of

[2] Weed, Lewis H. Some limitations of the Monro-Kellie hypothesis. Arch. Surg., 1929, xviii, 1049.

[1] From the Departments of Surgery and Nervous and Mental Diseases and the Laboratory of Surgical Research, Northwestern University Medical School.

the third cervical vertebra, an operation has not been performed. When the patient consents to an operation the result will be published in a further communication. The other patient, a female aged 36, presented the picture of a slowly progressive brachial and crural paraplegia with a poorly defined sensory level but with a motor level which pointed to a localization of the lesion at the fourth cervical segment. A complete spinal subarachnoid block was demonstrated by manometric study and this method of localization was applied. After all the cerebrospinal fluid had been withdrawn from below the lesion, successive injections of 5 cubic centimeters of normal saline solution at body temperature were made. There was a critical rise in the fluid level of the manometer at a height which corresponded to the spine of the third cervical vertebra. One of us performed a laminectomy and removed a meningeal fibroblastoma intradurally located beneath the lamina of the fourth cervical vertebra.

Although we believe that the usual sign of the level of compression is indicated by a sharp rise in the fluid level in the manometer after the level of the compression has been reached, in the case alluded to, which has not been operated upon, a reading was obtained which indicated that under certain conditions the dural sac continues to be filled out after the level of compression is reached and a plateau appears in the graph of figures immediately below this level. For example, after successive injections of 5 cubic centimeters of normal saline solution at body temperature a rise in the manometer of 3.5 cubic centimeters was seen, then a succession of four readings of 5, after which there was a rise to 8. The level opposite the figure 5 corresponded accurately to the level determined by clinical examination.



The method would lend itself equally well to tumors of the cauda equina. In this case it would be necessary to invert the table so that the patient is supported with his head down. Sufficient cerebrospinal fluid should be removed to allow the level of cerebrospinal fluid in the dural sac to be well below the needle. Then the same technique can be applied.

SEPARATION OF THE SYMPHYSIS PUBIS[1]

JOSEPH G. WISHNER, M.D., AND LEO MAYER, M.D., NEW YORK

SEPARATIONS of the symphysis pubis fall etiologically into two groups. In the first the separation is caused by some severe external trauma, such as the fall of a heavy weight against the abdomen. Such cases are usually complicated by extensive visceral injuries and the percentage of mortality due to these complications is so high as to render the correction of the bony separation a subject for theory rather than for practice. This group of cases is unquestionably small and relatively unimportant. The second group is limited to those occurring during parturition. In these the pubic bones are forced apart by the descent of the fetal head either with or without the complicating action of forceps. Previous statistical evidence would seem to indicate that this second group is also extremely rare. Thus Tuley reports only one case in 30,000 deliveries, Morgan 4 cases in 80,000 deliveries at the Lying in Hospital. At the Sloan Maternity Hospital only 3 were noted in 4,500 patients. Kayser found only 3 in 94,000 cases.

Despite these figures we have ourselves within a year been able to observe 5 postpartum cases and have without conducting an extensive inquiry, been informed of 6 additional cases. We have, therefore, gained the impression that separations of the symphysis pubis occurring during parturition are not as rare as have been supposed and that the apparent rarity of the lesion is due chiefly to lack of recognition. We are writing this paper, first, to emphasize the comparative frequency of separations of the symphysis pubis as a postpartum complication; second, to facilitate diagnosis by description of the typical syndrome; third to explain by cadaver studies the mechanics of the lesion; fourth, to describe an effective, simple method of treatment.

ANATOMY AND PHYSIOLOGY OF THE SYMPHYSIS PUBIS

The articulation between the pubic bones is an amphiarthrodial joint formed by the junction of two oval articular surfaces. These bones are held together by four strong ligaments, the anterior pubic (most powerful), the posterior pubic, the superior and inferior (arcuate.) It is maintained by some anatomists that normally there may be slight up and down motion at this joint, but the authors in their study both of the cadaver and of the living have never been able to demonstrate the least motion in the normal articulation. During pregnancy, however, there occurs a marked relaxation of all the pelvic ligaments which may permit a separation of the symphysis even before delivery (Lynch). Ralph Beach reports a case in which this separation amounted to four fingers. This relaxation unquestionably predisposes to the separation caused by the descent of the fetus.

MECHANICS OF THE SEPARATION

The cause of the separation is unquestionably the distending effect of the fetal head acting against the pelvic ring which gives at its weakest spot. Frequently, forceps are a potent factor (Eastment, Havaje-Weiz). What the exact pathology is we still do not know since no case has been adequately autopsied. In one instance reported by Boisliniere and in another by MacPherson, a distinct crack was audible during delivery, thus suggesting an actual tear. We have however, been unable to find similar reports and it certainly did not occur in any of the cases studied by us. It would, therefore, seem to be an exceptional occurrence. There is certainly no X-ray evidence to bear out the contention of some authors that the rupture takes place through the cartilaginous attachment to the pubic bone on one side or the other. In the absence of exact pathological data, we can only hazard the guess based upon our cadaver studies, Lynch's researches and the clinical data, that the separation is usually due to a stretching of the ligaments rather than to a complete rupture.

When the symphysis pubis separates there is bound to be a separation of the anterior portion of the sacro-iliac joint either of one or both sides. This complicating lesion of the sacro-iliac joint is usually unilateral as evidenced by the X-ray examination and involves so far as we can observe chiefly the anterior sacro-iliac ligaments. To study the mechanism of its production we removed a pelvis from a female cadaver with all the ligaments intact. The femoral heads were left in the sockets and the shafts were sawed off 3 inches below the hip joints. Roentgenograms were then taken from above downward and also in the anteroposterior plane (Fig. 1). After the pubic ring was cut through at the symphysis pubis, the pubic bones were pried apart a distance of 4 centimeters. As this was being done the anterior sacro-iliac ligaments were observed to

[1] From the Orthopedic Service of Dr. Leo Mayer, Hospital for Joint Diseases, New York City.

Fig. 1. Anteroposterior roentgenographic view of pelvis which was removed from female cadaver.

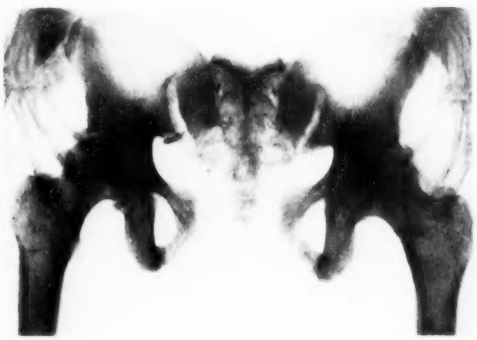


Fig. 2. Anteroposterior X-ray view of pelvis removed from female cadaver after the symphysis pubis had been pried open. Note the separation of the sacro-iliac joints.

give way and the anterior portion of the right sacro-iliac joint gaped open a distance of about 3/8 inch, the left about 1/4 inch (Fig. 2). The therapeutic significance of these anatomical observations is obvious and will be emphasized later under the discussion of therapy.

CLINICAL PICTURE

All of our patients gave a similar history which varied in degree rather than in kind. Following delivery they felt pain in the pubic region and in the lower back, in some instances extending down the thigh. Some had difficulty in moving the legs even when in bed. On getting up at the end of the puerperium, they experienced more pain and found that they had difficulty in walking. Some felt a distinct separation of the pubic bones with each step.

The objective examination was so typical that after the first case had been studied, the others were diagnosed without roentgenogram. The gait is a peculiar waddle as characteristic of this lesion as is the gait of a bilateral dislocation of the hips. Once seen, it in itself suffices to make the diagnosis. There is in addition definite tenderness in the region of the symphysis pubis, and one or more fingers can be inserted between the pubic bones. There may be tenderness of one or the other sacro-iliac joint. The peculiar feature of the sacro-iliac involvement is the absence of spasm of the hamstring muscles. In this respect this type of injury of the sacro-iliac joint differs from almost all other sacro-iliac lesions which we have observed. The patient may have difficulty in raising the heel from the bed and there may be weakness in the execution of other motions of one or both hips. When the patient is asked to stand on one leg, the pelvis usually sinks slightly toward the opposite side (positive Trendelenburg sign). This sign is more marked when the patient stands on the side complicated by the sacro-iliac lesion. It is frequently possible to demonstrate motion at the symphysis pubis by abducting the legs or alternately moving them up and down. The roentgenogram confirms the separation of the symphysis pubis and also shows a separation of the anterior portion of one or both sacro-iliac joints.

ANALYSIS OF THE LIMP

On first thought, the limp would seem to be due entirely to the instability of the pubic arch. Unquestionably this is the chief factor, but there is another the significance of which is not as obvious. To appreciate this second factor, the reader is asked to compare Figure 3, a roentgenogram of a pelvis removed from a female cadaver viewed from above downward, with Figure 4, a similar roentgenogram of the same pelvis after the pubic bones have been pried apart a distance of 4 centimeters. It is evident that owing to this separation there is a marked deviation in the relationship of the hip joints from the normal. This change is brought out more clearly by drawing the lines $A'\ A'$ and $A\ A$ joining the anterior margins of the acetabula, $B'\ B'$ and $B\ B$ joining the anterior border of the pubic bones. The backward displacement of the hip joints is evidenced graphically by comparing the line $A\ C$ in Figure 4 with $A'\ C''$ in Figure 3. These lines represent the vertical distance between the anterior border of the pubic bones and the anterior border of the acetabula. This backward displacement and change in the direction of the hip joint is illustrated even more clearly by a diagrammatic

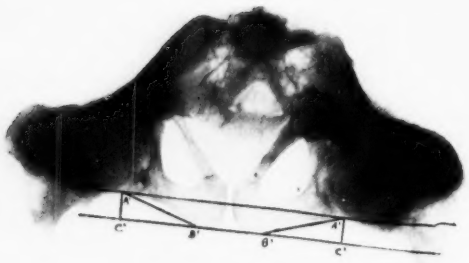


Fig. 3. Roentgenogram of pelvis removed from female cadaver taken from above downward showing the normal plane of the acetabula.

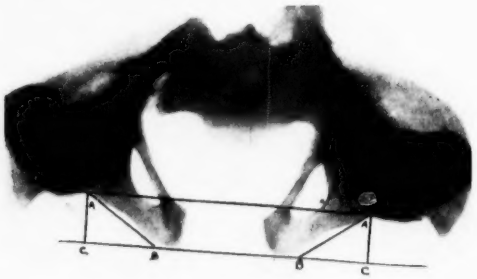


Fig. 4. Roentgenogram of pelvis removed from female cadaver, taken from above downward after the pubic bones had been separated a distance of 4 centimeters. The lines *A A* and *A' A'* have been drawn parallel to the anterior lip of the acetabula. The lines *B B* and *B' B'* have been drawn connecting the spines of the pubic bones. The vertical distance between these lines, *A C* and *A' C'*, has been markedly increased by the separation of the symphysis pubis. This indicates the posterior displacement of the acetabula.

cross-section of the pelvis at the level of the symphysis pubis (Fig. 5). The dotted lines indicate the pelvic outline after separation of the symphysis pubis. It is quite evident that the acetabula, subsequent to separation of the pubic bones, instead of facing forward and outward, face directly outward thus causing an external rotation of the thigh and a derangement in the mechanical action of the muscles running between the pelvis and the femur.

THERAPY

It is possible that were the lesion recognized immediately after parturition, firm strapping with adhesive plaster running from the anterior spine on one side to the anterior superior spine on the other, might overcome the separation of the pubic bones. The cases, however, which came to our attention had with one exception, all been up and about for some time and traction by means of adhesive plaster held out little prospect of reducing the separation. Operative procedures have already been described (bone graft suggested by Albee, wiring suggested by Allen).

It seemed to us advisable to try non-operative measures before adopting either of these procedures. Our study of the pathology of the lesion indicated that there were three important mechanical derangements: (a)—separation of the pubic bones, (b) separation of the anterior portion of the sacro-iliac joint of one or both sides, (c) a posterior displacement of the acetabulum, and a consequent change in the plane of the hip joints which faced almost directly laterally instead of anterolaterally. The treatment, therefore, had to correct all three pathological changes. The arc of correction ought to correspond so far as possible with the arc of the pathological separation. The device illustrated in Figure 6 meets these requirements.

By the application of a powerful circular compression to the pelvis the pubic bones are brought together, the gaping sacro-iliac joints are closed and the acetabula are restored to their normal plane. The mechanism of the correction is shown more clearly in the diagram, Figure 7.

The patient's back is first firmly strapped in the region of the sacro-iliac joints so as to afford support to the posterior sacro-iliac ligaments, and she is placed in bed on her back. A canvas swathe 6 to 8 inches in width (depending upon the size of the patient) and long enough completely to envelop the pelvis and extend 8 or 10 inches beyond the body is made to encircle the patient from behind forward (Fig. 6). At each end of the swathe is inserted a wooden spreader to prevent wrinkling. To this spreader is attached a rope which runs over a pulley attached to a wooden frame on each side of the bed. To this rope a weight is attached. Beginning with 5 pounds this weight may rapidly be increased to as much as 25 pounds on each side. The swathe exerts a continuous compressive force, working in an arc corresponding to that of the pathological separation, gradually bringing the pubic bones into normal relationship and reducing the separation of the anterior portion of the sacro-iliac joints. The process if properly supervised is painless. The duration of treatment varies depending upon the duration and the degree of the separation of the symphysis pubis. In a mild case seen 3 weeks

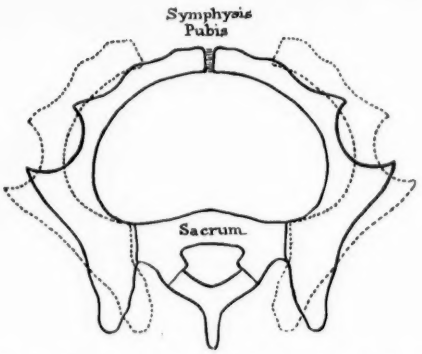


Fig. 5. Diagrammatic cross sections of the pelvis indicating the normal relationships and the pathological (dotted lines) after separation of the symphysis pubis. This diagram illustrates the posterior displacement of the acetabula after separation of the symphysis pubis and the change in the direction of the acetabula which face directly outward instead of forward and outward.

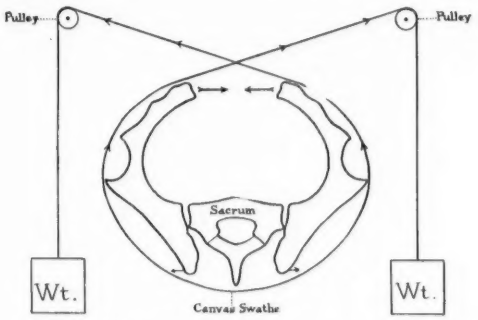


Fig. 7. Diagram illustrating the lines of force in the authors' method of correcting separation of the symphysis pubis. Note that the direction of the corrective force is such as to close the sacro-iliac joints as well as the symphysis pubis.

after parturition, 10 days were sufficient for correction. In our first patient who was seen 6 months after delivery, 3 weeks were required before the result was satisfactory although after 1 week there was a definite diminution in the separation. In these long standing cases the separation is likely to recur when the patient gets out of bed. To prevent this we equipped our patients with a specially constructed corset in which a strong strap running beneath the anterior superior spine, enabled them to apply a similar compressive force even when walking about. This sufficed for all the cases that came under our care, but it would seem to us highly probable that in patients in whom the lesion has existed for a year or longer, this type of support would be ineffectual and operative measures would be necessary. When confronted with this type of case we shall have no hesitancy in performing a bone graft operation of the type suggested by Albee, after the separation has been overcome by the method of circular compression.

The roentgenograms taken during the course of treatment showed that in cases seen comparatively soon after parturition (2 or 3 weeks) a perfect anatomical as well as functional result could be secured. In cases of long standing, good function resulted but a slight separation of the symphysis persisted (1.5 centimeters being the maximum). To determine how far this exceeded the normal, we measured the roentgenograms of 20 normal female pelves, and found a considerable variation in the separation of the pubic bones at the symphysis. This ranged from 0.3 centimeters to 0.8 centimeters. In our review of the literature we also found that Ralph Beach reported a persistent separation of 3 centimeters without symptoms. These facts indicate that a perfect anatomical correction is not necessary and that the roentgenogram, though important, is not to be considered the final criterion of cure. This would seem to be rather the restoration of the normal stability of the pubic arch and the realignment of the sacro-iliac joints. In this conclusion we are

Fig. 6. Photograph illustrating the author's method of correcting separation of the symphysis pubis. The broad swathe passes completely about the patient's body, and, crossing in front, exerts strong corrective pressure by means of the weights attached to cords running over the pulleys attached to the wooden uprights on each side of the bed.

Fig. 8. Anteroposterior view of patient 1 at time of admission to hospital, showing separation of the symphysis pubis of 4 centimeters.

Fig. 9. Roentgenogram of patient 1 taken in bed after removal of the corrective traction.

strengthened by our study of Case 6, in which the symptoms were evidently due to the weakness of the pubic ligaments without demonstrable separation of the pubic bones.

CASE REPORTS

Case 1. Mrs. R. R., aged 34 years. Past history revealed nothing of importance. Pregnancy had been normal, and delivery occurred November 30, 1925, forceps being applied after labor had lasted 4 days. Although the head was very large, delivery was successfully accomplished. As soon as the patient reacted, she complained of pain in the pubic region, in the right hip and in the right sacro-iliac joint and inability to move her legs. No lacerations in the vaginal wall were noted. There was bladder retention and she was catheterized for 6 days. A diagnosis of separation of the symphysis pubis was made. The patient was treated with adhesive strapping applied over the anterior lower half of the abdomen and kept in bed 3 weeks. On rising she had pain and walked with a marked limp. She was then admitted to a hospital where roentgenograms showed a separation of the symphysis pubis of 4.5 centimeters. Treatment consisted of adhesive strapping encircling the lower half of the abdomen and after 5 weeks she was discharged wearing a belt. The original separation was slightly diminished but the patient considered her condition unimproved.

On May 11, 1926, 6 months after parturition, the patient consulted us. She complained chiefly of pain in the region of the pubis, the right hip and the right lower back, and of an annoying sensation of the bones moving in the lower part of the abdomen when she walked.

Physical examination. When she stood an increase in the lumbar lordosis was noted. There was slight tenderness between the two pubic bones and a space admitting two fingers. There was no tenderness about the right hip and none over the sacro-iliac joints. The patient could not raise her right heel from the table without assistance. When the legs were abducted, motion of the pubic bones at the symphysis pubis could be detected. The patient walked with the peculiar waddle characteristic of the lesion. There was no shortening of the lower extremities; there was no hamstring spasm. Vaginal examination disclosed only the separation at the symphysis pubis. The roentgenogram showed a separation of 4.5 centimeters (Fig. 8).

The mechanical device already described was then applied (Fig. 6). At first 10 pounds were hung on each side and later the weights were increased to 15 pounds. More than this the patient could not tolerate. Traction was continuous night and day except at meal time when the patient was allowed to sit up in bed.

Within one week a definite diminution in the separation was noted. After 2 weeks of treatment the space was apparently closed. When the patient sat up, however, 0.5 centimeters separation could be felt (Fig. 9). After 4 weeks the patient was allowed to stand up; then a separation of 1.5 centimeters was evident but without any pain or disability. After an attempt to use a plaster-of-Paris corset, a special corset reinforced by canvas straps was applied and with this the patient was allowed to leave the hospital. She was entirely cured of her pain; she walked without a limp or waddle. She had complete power at the right hip. There was no longer an abnormal mobility at the symphysis. No space was palpable between the pubic bones, but the roentgenogram still showed a separation of 1.5 centimeters (Fig. 10). The gaping of the sacro-iliac joint had been completely reduced.

Case 2. Mrs. R. C., aged 29 years, was delivered of a dead baby weighing 9 pounds October 13, 1927. Forceps had to be applied. Post partum there was severe bleeding and blood transfusion had to be done. Patient had severe pain in the lower back and right hip. She could not turn because of pain and weakness of the legs and so lay on her back for 5 weeks. She could not move either leg. If the legs were abducted patient screamed and the nurse had to bring them together. She had to be catheterized for one week. After 3 weeks some power in the legs returned. No diagnosis was made until this patient came to the dispensary of the Hospital for Joint Diseases, December 8, 1927, 2 months after the onset of her trouble. Then she complained of pain in the right lower back, right hip, and down the right thigh and calf. She walked with a decided tilt to the right but her gait was not of the typical waddling type. It was rather suggestive of weakness about the right hip joint. She could walk about for only a short time. There was no pain when she remained quiet in bed but turning over was uncomfortable.

Fig. 10. Anteroposterior view of pelvis of patient 1 six months after discharge from hospital. Patient was entirely without symptoms though the X-ray picture still shows a separation of 1 centimeter.

Examination showed that there was a slight list to the left in an attempt to keep the weight off of the right side. When patient was asked to stand on the right leg, the left side of the pelvis tilted downward a trifle—positive Trendelenburg sign—(Fig. 11). The muscles of the right hip were decidedly weak. There was no hamstring spasm. The pubic bones were separated enough to admit one finger and there was marked tenderness in the space between them. There was a slight tenderness of the right sacro-iliac joint. Roentgenogram showed a separation of 3 centimeters and slight separation of both sacro-iliac joints.

The patient was admitted to the hospital December 17, 1927. The pelvic compression device was applied and the separation gradually reduced. She was discharged February 22, 1928, without limp or pain. She has reported regularly at the clinic. She is able to walk without pain but still has to wear the corset with webbing straps.

Case 3 (courtesy of Dr. H. Sonnenschein). Mrs. B. H., aged 33 years. Six weeks before admission she was delivered of her second child. After severe labor, forceps had to be applied. She was admitted to the hospital January 27, 1927, complaining of difficulty in walking which became evident 10 days postpartum, when she first got out of bed. Three weeks later she experienced a sudden sensation of something stretching or giving way and fell in a faint. Since that time she has been unable to walk. The patient has some pain even when lying quiet.

Examination shows a gap between the symphysis pubis admitting two fingers; the space is quite tender. There is tenderness of both sacro-iliac joints. The patient is unable to walk. The compression device was applied and kept on until February 20 (3 weeks). At the time of discharge the gap between the pubic bones had been markedly reduced. The finger could not be inserted between the pubic bones. The patient was able to walk but with a slight waddle in her gait. She was equipped with a special corset and after a few months the waddle entirely disappeared. The patient's present condition is normal.

Case 4 (courtesy of Dr. Both). Mrs. B., aged 34 years. She was delivered February 14, 1928 at the St. Joseph's Hospital, Far Rockaway, of her third child. It was a breech presentation; a manual dilatation and extraction was done without any special difficulty. On the fourth day postpartum she complained of severe pain in the vagina, on the tenth day when allowed out of bed she was unable to walk because of pain. Vaginal examination at this time showed nothing abnormal. At about this time Dr. Both

Fig. 11. Photograph of patient 2 illustrating the drooping of the pelvis on the left side when the patient brought all her weight to bear on the right hip (positive Trendelenburg sign).

happened to hear of the cases of separation of the symphysis pubis being treated at the Hospital for Joint Diseases and requested a consultation, suspecting that his patient might be suffering from this condition. She was seen March 10, 3½ weeks after delivery.

Examination showed a separation of almost two fingers between the pubic bones. There was marked tenderness in this region and also of the left sacro-iliac joint. The patient could stand for a few minutes but was unable to walk. X-ray picture showed 2 centimeters separation of the symphysis pubis. The compression device was applied, 10 pounds on each side. This was increased to 20 pounds. After 10 days the separation had been overcome and the patient left the hospital. She continued treatment at home for another 10 days. At the expiration of this time she was allowed up and about, wearing a sacro-iliac belt. When last seen, 6 months later she was entirely without symptoms.

Case 5. Mrs. H. G., aged 24 years. This patient was first seen February 3, 1928. She gave a history of a congenital hip dislocation. Eighteen months before, after delivery of her first child, she had had great difficulty turning in bed and when allowed to stand had had difficulty in walking. The limp which she had had since childhood developed into a waddling gait. She was given no treatment at the time and according to the records of the hospital where she was confined, no abnormality was noted. One

year later she was delivered of a second child (July 20, 1927); the delivery was spontaneous and the child quite normal. Owing to pain and difficulty in walking, an X-ray picture was taken which showed a separation of the symphysis pubis of almost 3 inches, and a widening of the right sacro-iliac joint. She was given a fixation corset which, however, helped her very little. When first examined by us, the patient showed a waddling gait peculiar to separation of the symphysis pubis. The symphysis pubis admitted 3 fingers easily. There was marked tenderness in this region. The patient was admitted to the hospital February 16. The compression device was applied, at first with 10 pounds on each side, gradually increasing to 25 pounds. She was discharged March 26. An X-ray picture showed that the separation of the pubic bones had been reduced to 1.5 centimeters. On palpation it was impossible to insert the finger between the pubic bones. The patient was equipped with a special belt which she has been using ever since.

CASE 6. Mrs. M. E. B., aged 32 years, is reported not as a separation of the symphysis pubis but as a closely related condition which pre ented features peculiarly like those of a separation. The symptoms dated back 7 years to delivery of her first and only child. The patient complained of difficulty in walking and particularly in going up stairs. Because of this the patient had consulted numerous physicians but had been given no relief. The symptoms had been gradually progressing until the patient had great difficulty in getting about.

Examination showed that the patient walked with a waddle suggestive of that of a separation of the symphysis pubis but differing from it slightly. At the symphysis pubis there was a slight apparent sag between the bones and very marked tenderness. There was also marked tenderness of the right inferior sacro-iliac ligament, somewhat less of the left. There was muscular weakness of all the muscles about the right hip. The reflexes were normal. X-ray picture showed no separation but a definite abnormality of the right pubic spine strongly suggestive of an old fracture.

In view of the close resemblance of the symptoms to those of a sacro-iliac separation, it was decided to try a similar line of treatment. It was argued that even though there was no separation of the pubic bones, there was a weakness of the pubic ligaments and of the sacro-iliac ligaments. The patient was accordingly placed in the typical traction device after adhesive plaster strapping had been applied to the sacro-iliac region. She was admitted to the hospital January 17, 1927, discharged February 22, 1927. The tenderness in the pubic region gradually disappeared, also that of the sacro-iliac ligaments. After 3 weeks under traction the patient was able to lift the right heel from the bed, something which she had been unable to do since the childbirth, 7 years before. She was discharged, wearing a sacro-iliac belt and a firm supporting corset. She maintained the traction treatment at home most of the time for the next 2 months. Gradually she was allowed more and more time out of bed. Six months later traction was discontinued except during the menstrual period when the patient found that if the traction were not applied, she had a slight return of the original symptoms. At the time of writing the patient is normal.

SUMMARY

The authors' conclusions from a study of five typical cases of postpartum separation of the symphysis pubis and a sixth case of probable fracture of the pubic spine resembling the others in symptomatology, are the following:

1. Postpartum separation of the symphysis pubis is comparatively frequent.

2. The syndrome is so typical as to make its recognition easy. The chief symptoms are pain in the region of the pubic bones, a palpable separation, difficulty in walking and usually a typical waddling gait.

3. Separation of the symphysis pubis is invariably accompanied by a corresponding gaping of the anterior portion of one or both sacro-iliac joints. The limp is due chiefly to the instability of the pubic arch and to the weakness of the sacro-iliac joints, in less degree to the posterior displacement of the hip joints which instead of facing anterolaterally, face laterally.

4. The treatment must correct all three pathological lesions. This can be accomplished by applying a powerful compressive force to the pelvis which gradually rotates the innominate bones from behind, forward and mesially thus closing the gaping sacro-iliac joints and bringing the pubic bones into normal alignment.

5. Functional cure is possible even though a slight persistent separation of the symphysis pubis is roentgenologically demonstrable.

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THE HYPERTROPHY OF FASCIA AND ITS USE IN THE REPAIR OF LARGE SCROTAL HERNIÆ[1]

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THE literature on the use of fascia in the repair of inguinal herniæ is voluminous. However, there are almost no pertinent observations on the hypertrophy of the fascial layers which develops to such a striking degree in large scrotal herniæ of 5 to 10 years' duration. Halsted, in 1903, called attention to the use of the cremaster and remarked: "It is a step of the operation to which one is irresistibly drawn in some cases by the great strength of the cremaster and the firmness of its attachment to Poupart's ligament." He emphasized the hypertrophy of the cremaster muscle saying little about the cremaster fascia and nothing about the hypertrophy of other fascial layers. The purpose of this paper is (1) to call attention to the hypertrophy of the fascial layers occurring in large scrotal herniæ of relatively long duration, and (2) to present a method of utilizing this fascia in the repair of this difficult class of herniæ.

ABNORMAL ANATOMY

For the purpose of brevity the term, scrotal hernia, will be used hereafter not in the ordinary sense of a simple hernia within the scrotum, but rather to designate an inguinal hernia which has been in the scrotum for a length of time sufficient to result in a marked hypertrophy of the fascial layers. It is impossible to state arbitrarily how long a hernia must have been in the scrotum to result in this hypertrophy, because it is the outgrowth of the adaptation of tissue to the new demands. Therefore, it is obvious that the degree of hypertrophy of fascia will depend, among other things, upon the force required to restrain the further progress of the hernia which is in turn determined by the size of the hernial ring, the intra-abdominal pressure (occupation, coughing, etc.), and whether the individual has worn a truss or suspensory as well as upon the time element.

In order to appreciate the possibilities of utilizing these hypertrophied fascial layers it is desirable briefly to review the salient points of their embryological development. As the testes descend into the scrotum they carry with them the fascial planes through which they pass and a few fibers of the internal oblique muscle.

The intercolumnar fascia (external spermatic fascia) lies immediately beneath the dartos. It is the continuation of the deep fascia which overlies the external oblique muscle and is adherent to the aponeurosis of that muscle. It is carried downward with the descent of the testicle, and is normally a thin filmy layer which can be demonstrated by injecting fluid beneath the aponeurosis of the external oblique when the fascia covering the cord becomes distended. The hypertrophy of this translucent layer of fascia is brought out to a striking degree in scrotal herniæ (Figs. 1 and 8).

Fig. 1. Dissection of hypertrophied fascial layers. *E.Ob.*, External oblique; *I.Ob.*, internal oblique; *Tr.M.*, transversalis muscle; *Tr.F.*, transversalis fascia; *E.R.*, external ring; *I.F.*, intercolumnar fascia; *C.M.F.*, cremaster muscle and fascia; *Inf.F.*, infundibuliform fascia; *P.*, peritoneal sac.

[1]From the Surgical Clinic of the Peter Bent Brigham Hospital and the Department of Surgery, School of Medicine, Yale University.

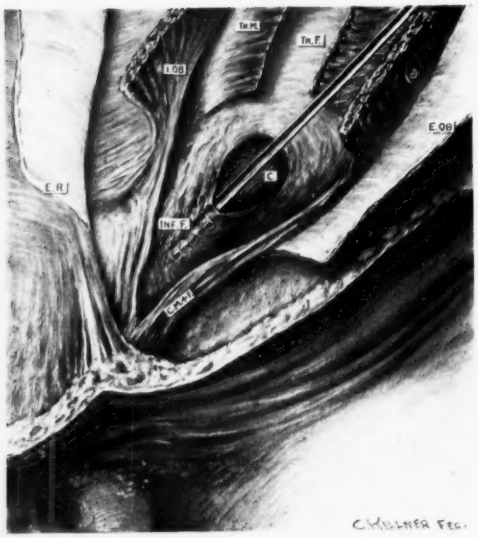

Fig. 2. Dissection of normal side of the same cadaver. The intercolumnar fascia could not be developed and is not shown. Note the thin layer of infundibuliform fascia, *Inf.F.*, compared with Figure 1. *E.R.*, External oblique; *I.Ob.*, internal oblique; *Tr.M.*, transversalis muscle; *Tr.F.*, transversalis fascia; *C.M.* and *F.*, cremaster muscle and fascia; *C.*, spermatic cord.

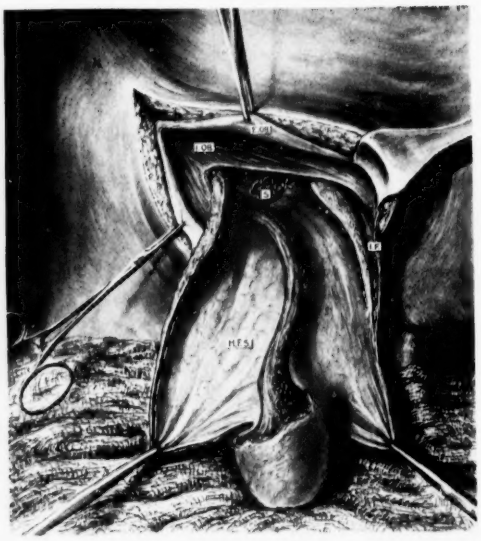

Fig. 3. *H.F.S.*, Hypertrophied fascial sac dissected free from the cord and testicle; *E.Ob.*, external oblique; *I.Ob.*, internal oblique; *I.F.*, intercolumnar fascia; *S.*, ligated peritoneal sac.

Inasmuch as it is continuous with the aponeurosis of the external oblique, it is necessary to incise this fascia transversely on the posterior portion of the fascial sac in order to expose Poupart's ligament and thus free the lower flap of the external oblique aponeurosis.

The cremaster fascia (middle spermatic fascia) and muscle is described as loops of muscle fibers

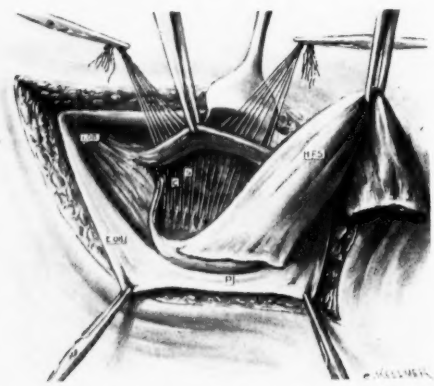

Fig. 4. The first row of mattress sutures has been placed and partially drawn up. The cut edge of the intercolumnar fascia is shown on the posterior surface of the hypertrophied fascial sac, *H.F.S.* *C.*, Stump of cord shown as amputated for sake of clearness. *S.*, Ligated peritoneal sac; *E.Ob.*, external oblique; *I.Ob.*, internal oblique; *P.*, Poupart's ligament.

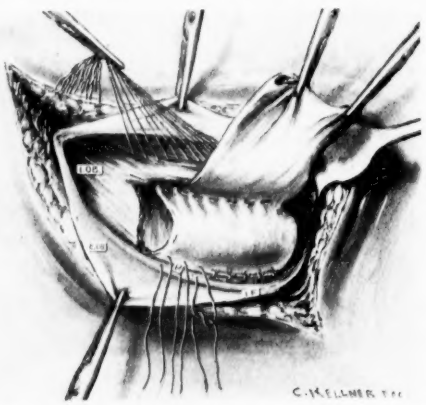

Fig. 5. The first row of mattress sutures has been tied and is shown almost out of sight under the edge of the external oblique, *E.Ob.* The second row of sutures has been placed through Poupart's ligament, *P.* The third row of sutures is shown drawing a fold of the fascia upward beneath the internal oblique, *I.Ob.* *E.Ob.*, External oblique. *I.F.*, Cut edge of intercolumnar fascia.

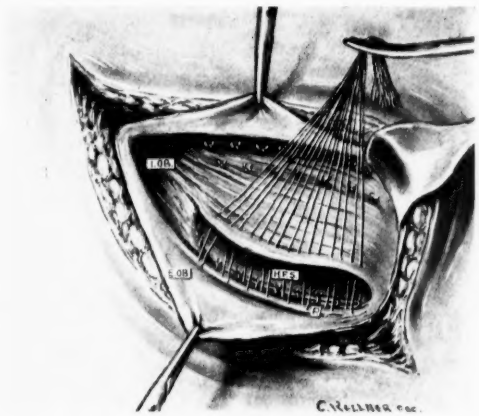

Fig. 6. The first, second, and third rows of sutures have been tied. The last row of sutures has been placed through Poupart's ligament, *P.*, and the internal oblique, *I.Ob.* If desired the end of the hypertrophied fascial sac, *H.F.S.*, may also be brought down with this row. *E.Ob.*, External oblique.

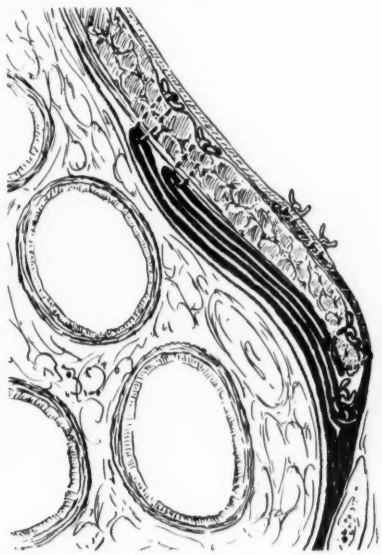

Fig. 7. Cross section showing the relation of the reduplicated hypertrophied fascial sac.

held together by areolar tissue and forming a thin covering over the cord and testis. I have mentioned the cremaster fascia first because the marked hypertrophy which takes place is predominantly in the fascia, the muscle bundles increasing somewhat in size, but becoming so thinned out that for all practical purposes there is only a fascial layer (Fig. 9). The attachment of the cremaster to Poupart's ligament is greatly increased both in extent and strength, due to the hypertrophy of fascia.

The infundibuliform fascia (internal spermatic fascia) is described as a funnel-shaped thin membrane, a prolongation of the transversalis fascia, surrounding the cord and testis and enclosing them in a distinct covering (Fig.s 2). The hypertrophy of this layer is very marked (Figs. 1 and 10) and of extreme importance because it is, first, the innermost layer of fascia, or the primary defense to be used in the repair, and second, it is attached around the entire circumference of the hernial ring even at the inner angle where the defense is most needed.

The essential features of this abnormal anatomy are (1) the hypertrophy of fascia with its increase of tensile strength; (2) the wide origin of fascia throughout the entire circumference of the hernial ring, no matter how large, based embryologically on the fact that each layer is a funnel-shaped process; and (3) the fact that all layers are already attached to Poupart's ligament, thus providing a natural first line of defense independent of sutures and the hazard of uniting.

The material used to illustrate this paper was obtained from the body of a laborer 74 years of age. It was impossible to ascertain the exact length of time during which the hernia had been in the scrotum, but approximately 10 years. There was no history of having worn a truss. The material for the photomicrographs were also obtained from the same cadaver and all have the same magnification.

A METHOD OF REPAIR[1]

The essential feature of the operation is the utilization of the hypertrophied fascia, commonly considered a useless structure, and in the usual methods of repair, either partially excised or left as a bulky mass in the scrotum. While Figure 1 shows the layers dissected separately, it is obvious that in the operative procedure they are tightly adherent and should be treated as one layer. The term, hypertrophied fascial sac, has been used to designate these layers, for they form as true a sac as does the peritoneal covering. Only those steps are illustrated which differ from the usual hernial repair. For the sake of clearness the cord and testicle are shown as excised, although this is by no means a necessary step.

[1] This procedure is an amplification of Halsted's method of utilizing the cremaster muscle but here applied to the combined fascial layers.

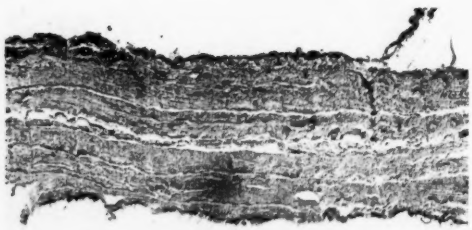

Fig. 8. The hypertrophied intercolumnar fascia (×80).

If there is doubt as to whether the fascia is sufficiently hypertrophied so as to be of use in the repair, the early steps of the operation may be carried out in the usual manner until the hypertrophied fascial sac is incised parallel with the cord when its true nature is revealed. The peritoneal sac is dissected free, transfixed, and doubly ligated as high as possible. The contents of the scrotum are readily delivered by following the cleavage plane between the intercolumnar fascia and the dartos when the cord and testicle can be dissected from the hypertrophied fascial sac (Fig. 3). In large scrotal herniæ there is not infrequently more fascia available than can be utilized, and it is then necessary to trim off portions, or, as has been done in some instances, to cut strips for use in a Gallie needle. However, I believe the latter is unnecessary, for if the fascial sac is well developed, there is adequate material and little or no tension on the sutures. The lower edge of the internal oblique and transversalis must be freed from the peritoneum as high as possible so as to allow the first layer of mattress sutures to be placed at least 4 centimeters from its lower border. One should exercise care in placing the mattress sutures so that the reduplicated folds of fascia are not left loose but are barely taut. There is usually sufficient material for a reduplication of two to three folds, the number depending on the size of the defect and the strength of the fascia. As has been pointed out by Koontz the union of fascia to fascia, or fascia to muscle, is firmer if care has been taken to remove all of the intervening fatty areolar tissue. This is important as this hypertrophied fascial sac not infrequently has considerable fatty deposits. As there may be two rows of sutures in Poupart's ligament, the first row should be placed as low as possible. For this I have used a fine needle with silk as it gives a minimum of trauma. The aponeurosis of the external oblique may then be treated in the usual manner and if it is thought best not to remove the testicle, an extra aponeurotic transplantation of the cord may be carried out.[1]

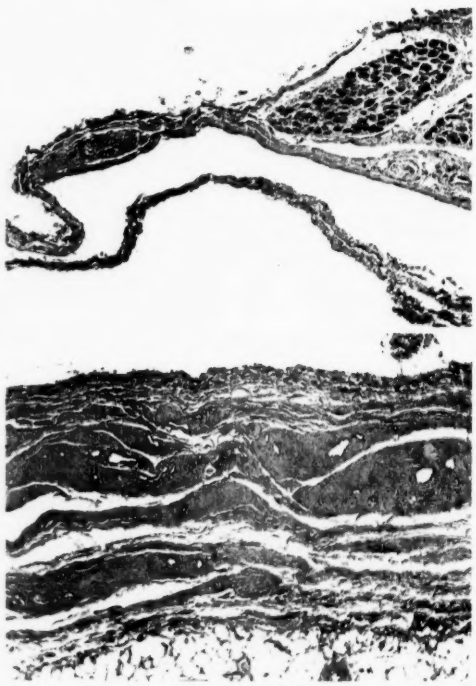

Fig. 9. Above, normal cremaster muscle and fascia (×80); below, hypertrophied cremaster muscle and fascia (×80).

DISCUSSION

With the operation for inguinal hernia as used today, it is obvious that this type of repair will be limited to a small group of selected cases as the vast majority of them are repaired at a very early stage of development. However, it is in this group that recurrence is most feared and in many instances expected. While the removal of the cord or testicle is acknowledged to be undesirable from a psychological standpoint, there is no sound physiological reason why it is not permissible in the group of cases of advanced age in which these herniæ are usually found.[2] The percentage of recurrence will be still further lowered and the technique of repair is undoubtedly facilitated. However, if desired, the cord can be transplanted in the usual manner.

[1] The method here described has been carried out on a group of selected cases during the past year and a half. While there has been no evidence of recurrence it is too early to report end-results.

[2] This, of course, assumes that the remaining testicle is normal. At times in large scrotal herniæ the testicle is already atrophic.

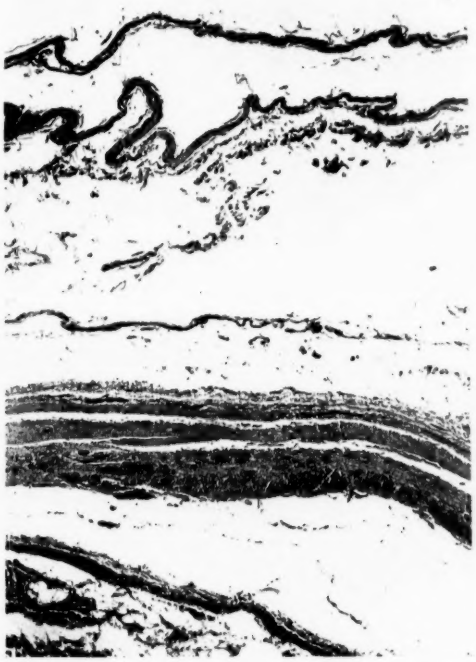

Fig. 10. Above, normal infundibuliform fascia (×80); below, hypertrophied infundibuliform fascia (×80).

These large scrotal herniæ do not fall into any well defined classification. From the standpoint of etiology they are almost invariably indirect, while from the standpoint of repair they are direct as the defect has been carried well over to the rectus or pubic spine. An alternative method now much in vogue is the use of strips of fascia lata as described by Gallie. However, in these selected cases there is available fascia already growing *in situ*, (Fig. 11) and already attached to Poupart's ligament and extending up on the edge of the rectus.

Some of the reasons for recurrence in these large scrotal herniæ may be summed up as follows: (1) large defects in the external oblique aponeurosis; (2) atrophy or defect of the internal oblique; (3) inability to approximate tissues at the inner angle or the tearing out of sutures under too great tension; (4) recurrence along a bulky cord where the ring is inadequately closed with atrophic muscle. These factors may be obviated by the procedure described in properly selected cases.

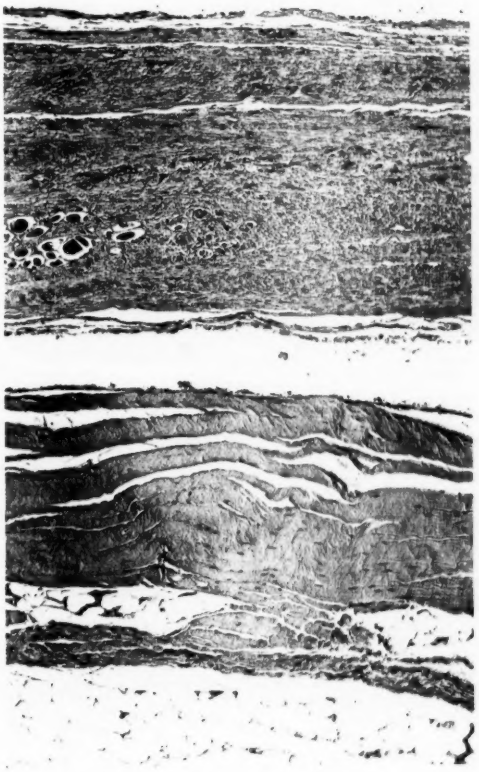

Fig. 11. Above, hypertrophied fascial sac just above testicle showing a few muscle bundles (×80); below, fascia lata from the same case (×80).

SUMMARY

1. Attention is called to the hypertrophy of fascia in scrotal herniæ.

2. A method is described for the utilization of this fascia in the repair of these herniæ.

3. On the basis of the abnormal anatomy and the fact that special procedures are needed in the repair, these large scrotal herniæ deserve a separate place in the clinical classification of inguinal herniæ.

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PLASTIC SURGERY OF THE EAR

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MEDICAL literature up to the World War contains little reference to plastic surgery of the ear. This field of surgery offers unusual difficulties because of the complicated structure of the ear, its rather isolated position, and the necessity of transplanting cartilage for proper support of the improvised ear. Wounds of the World War, however, and accidents incident to the mechanical age in which we live have forced upon the plastic surgeon the necessity of devising ways and means of reconstructing the ear.

The great vascularity of the ear makes possible a variety of plastic operations upon it. It receives its blood supply from the branches of the superficial temporal, the occipital and the postauricular arteries. Greatest difficulty is encountered in the reproduction of the various eminences and depressions of the external ear and of the external auditory canal.

Defects of the ear demanding surgical intervention may be divided into (1) congenital and (2) traumatic or acquired.

CONGENITAL DEFORMITIES

Congenital deformities may vary from entire absence of the ear to partially defective organs. The ears may be too large, the so called "donkey ears" or "sail ears" or they may be too small. Large ears often prove a distressing deformity and subject their owner to humiliating ridicule.

The most difficult feat in plastic surgery is reconstruction of the congenitally absent ear. In the most advanced cases the auditory canal is usually lacking and it is impossible to form a canal. X-ray films will enable one to determine the presence or absence of the internal structures of the ear. Should these be lacking, the most that can be hoped for is the formation of an external ear which will simulate a normal one. If only the lobe of the ear is present, as in the author's case, the ear must be reconstructed from the scalp above and behind the ear and stiffened by transplanted cartilage. Cartilage grows readily if embedded in the connective tissue layers of the skin. Cartilage may be transplanted from a rib, from the opposite ear, or from the remnants of cartilage above the meatus of the deformed ear. The auricle is formed of flaps which are freed from the scalp by means of a butterfly incision and are folded upon themselves where they are sutured together with their raw surfaces in contact. Rigidity is secured by transplanted cartilage.

The incision first suggested by Szymanowski many years ago is useful in forming an auricle. Several operations are necessary, extending over a period of 2 or 3 years. The final results are often surprisingly good.

In case of total ablation of the external ear it is possible to transplant an entire ear from one person to another by using the back of the hand as an intermediary host for the grafted organ. Fitch has reported a case in which a young man had his ear completely severed from his head. He immediately picked it up and hastened to the doctor's office where it was cleansed and sutured in place. It healed perfectly. This would suggest the possibility of using the ear of a person recently dead as a graft.

Prominent or donkey ears are not uncommon; they constitute an actual deformity and are due to a change in the angle at which the ear joins the head. This leads to a bending forward of the auricle. In such ears the antihelix is undeveloped or lacking. The ridges which form the eminences

Fig. 1. Congenital absence of ear.

Fig. 2. After second operation.

Fig. 3. Present condition.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 4. Friction burn. Ear partially destroyed.
Fig. 5. Wound grafted. Plastic operation on ear.
Fig. 6. Present condition. Wound healed and ear restored.
Fig. 7. Before operation. Upper one-third of ear absent.
Fig. 8. Tube graft.
Fig. 9. Lower pedicle of tube graft severed. Graft transplanted to ear.
Fig. 10. Graft growing to ear. Both pedicles severed.
Fig. 11. Final result.

Fig. 11.

and depressions of the external ear are, as pointed out by Luckett[1] due to fluting or folding of the cartilage. This deformity can be corrected by the removal of a crescentic segment of skin and cartilage from the posterior aspect of the ear. The cartilage is then sutured separately from the skin, the sutures being passed in Lembert fashion from one side to the other. Where these are tied the cartilage is rolled forward, thus producing a ridge on the anterior surface corresponding to the antihelix. Marked inequalities in the ears can be corrected by the removal of a portion of one ear through a V-shaped incision. The excised portion can be transplanted to the smaller ear if the disparity is great.

[1]Luckett. Surg., Gynec. & Obst., 1910, x, 635-637.

TRAUMATIC OR ACQUIRED DEFECTS

Here is the largest field for plastic surgery of the ear. The ear may be partially destroyed by malignant disease, by syphilitic ulceration, or by trauma. The auricle of the ear is most often destroyed. Two such cases are illustrated. One of these was due to a friction burn of the scalp and upper third of the ear by a rapidly revolving motorcycle wheel. This ear was reconstructed by the removal of a V-shaped piece from the under and inner surfaces of the auricle and suture of the denuded edges. The ear was reduced in size but its contour was excellent.

In another case a man had the upper third of his ear torn off in an automobile accident. The problem presented was to secure sufficient tissue to restore the auricle and render it rigid. The tube graft which came into use during the World War lends itself to the restoration of such defects. The entire operation can be done under local anæsthesia. The graft is first prepared from the non-hairy portion of the neck; two parallel incisions down to the fascia are made. The bridge of skin between these incisions is dissected up, folded upon itself and sutured. Particles of cartilage are taken from the tenth rib and embedded in the connective tissue of the graft. The skin is sutured beneath the graft. If tension is too great the edges may be undercut. At the end of 10 days the tube is severed at its lower end; its edges separated and accurately sutured with horsehair to the split and freshened skin of the ear. Ten days later the upper pedicle is divided and sutured in a similar manner to the posterior surface of the split auricle. The cosmetic result is excellent. In the case illustrated (Figs. 7 to 11) the patient is so pleased with his reconstructed ear that he desires an operation on his normal ear, which is of the "sail ear" type, to make it conform to the injured ear.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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WHEN SHOULD AN ILEOSTOMY BE PERFORMED IN CHRONIC ULCERATIVE COLITIS?

SIR SAMUEL WILKS,[1] as early as 1859, expressed the opinion that there was a difference between dysentery and certain forms of colitis, and in 1875[2] he separated "simple ulcerative colitis" from the other forms. His description of the symptoms and pathology cleared the way for later study and investigation, but his contention that the disease was a distinct entity was not accepted until quite recently. Those who have looked upon it as a separate disease have been unable to treat it satisfactorily; and, until Bargen began his work, no one had been consistent in his findings of the causative agent.

After Bargen discovered a Gram-positive, lancet-shaped diplostreptococcus in the lesions of the colon of patients having chronic ulcerative colitis, he succeeded in making a vaccine with which he has successfully treated many patients. Interest in this autogenous vaccine treatment is intensified by its importance in establishing the etiology of the disease. It is further heightened by the fact that there has not been in the past any one satisfactory treatment. Measures, such as medications, diet, and local irrigation, have been varied and their results correspondingly uncertain and meager. Surgery when resorted to has certainly prolonged the lives of many patients but the type of operation which gives the best result—ileostomy—is in its postoperative phase an unhappy one for the patient to endure.

Bargen has repeatedly isolated the diplostreptococcus since he began his investigations in 1923. A vaccine prepared from a pure culture of this organism and a bacterial filtrate injected subcutaneously has resulted at the Mayo Clinic in a complete cessation of symptoms in nearly one out of every two cases. For about three out of every four cases the improvement has been sufficient to allow the patient to resume a normal, active life. Results elsewhere have been less uniform. There are reports of the successful cure of patients treated with the vaccine, while there are others of a failure to isolate the organism described by Bargen, and, where it was isolated, a failure to effect a satisfactory cure with the injections.

This brings us to the question: when should an ileostomy be performed in case of chronic ulcerative colitis? Since the striking reports of Bargen's work, we have treated with autogenous vaccine five cases of chronic ulcerative colitis which we are reporting elsewhere.[3] These range from two very advanced

[1] Wilks, Sir Samuel. Lectures on Pathological Anatomy. 1859, p. 301.
[2] Ibid. 1875. p. 408.
[3] To be published in the J. A. M. A.

cases to one in an early, mild stage. In each instance the technique of Bargen was followed in cleansing the colon by repeated enemas, in removing the exudate from the base of an ulcer, and in curretting the base with a sterile platinum loop to obtain the material for culture. Rosenow's method, as published by Bargen, was followed in isolating the diplostreptococcus in pure culture and in preparing the vaccine and filtrate. In each of our five cases the result of the vaccine treatment was the same: a distinct improvement was noticeable soon after the injections were begun; this improvement continued and in a few months the ulcers in the colon were healed, and the patients were without symptoms. One patient, extremely ill when the treatment was begun, is now, a year and a half later, performing manual labor 11 hours a day.

When should an ileostomy be performed in chronic ulcerative colitis? Not until repeated attempts have been made to isolate the lancet-shaped diplostreptococcus; and, if the organism is found, not until the vaccine and filtrate injections have been tried. The technique which has been evolved after extensive experiments and research and which has given Bargen such excellent results, should be followed. In the case of the occasional patient who is brought to the surgeon seeking relief because the organism described by Bargen has not been found or because injections of stock vaccine have produced no improvement, and the patient's general condition is rapidly growing worse, ileostomy must be considered. Bargen[1] reports that out of 250 cases treated with vaccine at the Mayo Clinic during a three-year period, 1924-1926, it was necessary in only five cases to do an ileostomy. Stone[2] reported seven cases requiring ileostomy; and has suggested that it be employed "before the general condition becomes so serious as to be critical."

It seems that with the etiological factor well established and the autogenous vaccine treatment successful and in general use, the few cases requiring ileostomy will be those in which the vaccine or serum treatment has been a failure, or those in which treatment has been neglected and the entire colon badly damaged.

EDMUND HORGAN.
JOSEPH HORGAN.

[1] Bargen, J. Arnold. Chronic ulcerative colitis: bacteriologic studies and specific therapy. Tr. Am. Proctol. Soc., 1927, 28th Ann. Sess., 93-100.

[2] Stone, Harvey B. Chronic ulcerative colitis. Pennsylvania M. J., 1929, xxxii, 211-218.

CARELESS USE OF THE ENGLISH LANGUAGE

OUR British cousins use their language better than we do. A clinical lecture from a professional chair in London or Edinburgh is usually a model of correct speech. English medical literature is generally expressed in better constructed phrases, with superior choice of words and expression of ideas than is the average product of American medical writers. The rush of American life is perhaps responsible for the neglect of polishing our sentences. It is related that Flaubert, the great French novelist, would spend days polishing a single sentence so that it would become pleasing to the eye and ear. Such extreme assiduity cannot be expected of busy medical men, but there are certain glaring errors commonly used in medical writing and conversation to which our attention may profitably be called.

The first and foremost atrocity is the misuse of the word "operate." Such expressions as "I operated him," "The case was operated," and similar abominations, appear frequently in our standard medical journals, are used in conversation and, worst of all, are taught to the student in some of our best medical colleges.

The word "operate" is derived from the

Latin noun "opus" and verb "operari," meaning "work" and we should not say that we work a patient. Operate is a transitive and intransitive verb. A transitive verb is one that requires a direct object to complete its sense. Thus we may correctly say: "I operate a coal mine or a peanut stand or a cystoscope," "operate" being used as a transitive verb. In surgery, as far as the patient is concerned, operate is always intransitive. To satisfy our fondness for the use of the word operate and to use it correctly, we must limit our transitive use of the verb to operating the gas machine, the bone saw, the syringe, but we must not operate the patient.

The expression "plaster cast" is very commonly applied to a plaster splint which encircles, partly or completely, a limb or some part of the body. At the same time the word "cast" is commonly used in medicine to designate a mold of a hollow organ, as of a renal tubule or a bronchiole. Thus we have blood, epithelial, fatty, granular, hyaline, waxy, and other renal casts. So on the same patient we have the word "cast" used in contradictory senses—concerning the kidney tubule or bronchiole for something that is inside—concerning the limb for something that is outside. The dictionary gives twenty-seven different significations for this word of Scandinavian origin, varying from the "excrement of an earth worm" to "a throw of dice." The act of casting or founding; the quantity of metal poured; the impression or mold taken; that which is formed in a mold or form; a reproduction or copy of a work of art in plaster, are all correct uses of the word "cast." In the science of the treatment of fractures the meaning of the word "cast" has been twisted and misapplied to an apparatus or splint that comes in contact with some portion of the exterior of the body. This is evidently an abuse of the word, and there is no authority for such use of the word except the authority of a bad habit.

Another expression of lesser ill, but manifestly improper, is the common phrase "Has the patient any temperature?" One might as well ask "Has the patient any respiration?" Of course, the patient, if alive, has a temperature. What should be asked is "Has the patient any rise, change, or variation in temperature, or any fever?"

The word "hæmorrhage" means a flow of blood. "Hæmorrhage" is a noun and there is no verb "hæmorrhaging" in the English language, yet this word strikes the ear occasionally and even creeps into print.

The word "pathology" is defined by Dorland as "That branch of medicine which treats of the essential nature of disease, especially of the structural and functional changes caused by disease." By a curious quirk, the original meaning has recently become dislocated from a study of diseased tissue to the disused tissue itself. We hear such expressions from the operating room and morgue as, "no pathology of the gall bladder found," "exploratory incision revealed no pathology," and examination of chest plates conclude with the statement "there is no pathology in the lungs." We might as well say that the larynx shows no laryngology, the bladder shows no urology.

The terms "tuberculous" and "tubercular" are hopelessly mixed up. "Tuberculous" should be limited to any lesion or process caused by the bacillus tuberculosis; "tubercular" should be restricted to a condition in which tubercles or nodules are present.

We aim at accuracy in medicine. Exactness is necessary in prescribing, correctness is desirable in diagnosis, and accuracy is indispensable in surgery. May we not profitably give some attention to correctness in medical English?

JAMES R. JUDD.

MASTER SURGEONS OF AMERICA

CHARLES B. PENROSE

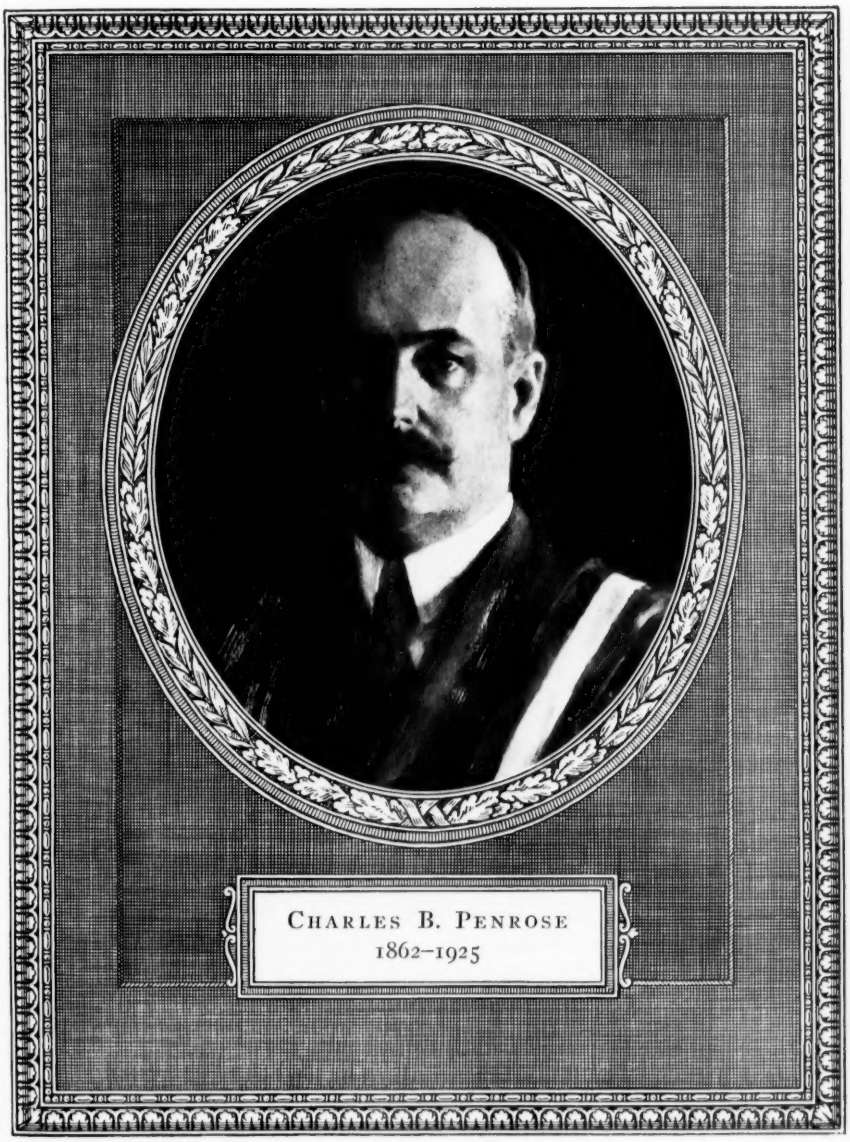
ALL men are born, and die. Most men marry. Many men fill, and worthily, public positions, are members of important commissions or boards, acquire wealth. These are matters of import during the life of the individual, or shortly thereafter, and to those with whom he has had social, professional or business relations. The data bearing on these matters are appended to this memorial.

As to the Penrose forbears, his brother, Richard A. F. Penrose, geologist of international reputation, president of the Academy of Natural Sciences, founder and one-time president of the Society of Economic Geologists, answered a query on this subject as follows: "On my father's side our first ancestor in this country was Bartholomew Penrose, who came to Philadelphia with William Penn about 1700. On our mother's side our direct ancestor was Governor Dudley of Massachusetts. Our ancestors on both sides have tried to be respectable, law-abiding people."

Charles B. Penrose was one of a family of long, strong, lean, handsome, active boys; guided in childhood by their exceptionally able, gifted, and devoted mother; later by their cultured and distinguished father, Dr. R. A. F. Penrose, professor of obstetrics in the University of Pennsylvania. To him, their father, because of his worldly wisdom, deep affection, and abiding belief in them, they rendered respect and obedience. With him, because of his vivid interest, full understanding, and large charity, they were as unrestrained in thought, word, and action as with each other.

Charles Penrose's first school was the Episcopal Academy; thence he went to Harvard, while a student contributing to scientific journals papers upon mathematical and physical subjects. He graduated with highest honors in physics in his nineteenth year. Such was his aptitude for this branch of science that, together with his A.B. degree, he was offered an assistant professorship, in the belief that he might become one of the leading physicists of his generation.

On leaving Harvard he entered the medical school of the University of Pennsylvania, at the same time continuing his studies in mathematics and physics at Harvard, where, by special permission of the University Council and on condition that he should spend two months of each yearly term at Harvard, he was



CHARLES B. PENROSE
1862–1925

allowed to try for the degree of Ph.D. In the spring of 1884, and at the age of twenty-two, he was given the degree of M.D. by the University of Pennsylvania and that of Ph.D. in physics by Harvard.

After completing his internship at the Pennsylvania Hospital, and while attached to its out-patient department and that of the old Philadelphia Dispensary, Penrose, operating in cellar and attic, convinced the profession that recovery from abdominal section could be made habitual rather than occasional; and that thereby many women condemned to a life of misery or a speedy death could be made well. It was about this time that the professor of surgery of the University of Pennsylvania characterized the abdominal operations of his colleague, the professor of gynecology, as "legalized murder"—and with some justice in so far as mortality was concerned.

It was while he was demonstrating, to a then skeptical profession, the safety of clean, deft, abdominal surgery, that as an outlet to his super-abundant vitality, Penrose swam the thirteen miles from Philadelphia to Chester. Thereafter, though not necessarily incident thereto, he suffered from a persistent cough with fever and loss of weight. Hoping that air, altitude, sunlight, and exercise might cure him he went to Cheyenne and dug with a shovel daily, leaving a landmark to which strangers were taken for years. Dr. A. W. Barber, then governor of Wyoming, wrote at this time: "Penrose is past all help. I doubt if you ever see him again."

When the big cattlemen with their cowboys and killers rode through Cheyenne on their mission of rustler extermination, Penrose joined them as surgeon, but was taken so desperately ill that in spite of his protests he was sent back to the town of Douglas. He was jailed on sight, which saved him from being shot. Believing his bichloride tablets were intended for poisoning the wells, lynching was promptly decided upon, but postponed until morning in the interest of a larger audience. His cellmate, red-handed murderer and horse-thief, offered him half of a pair of scissors, holding that suicide even by such a poor instrument was better than hanging. A special train from Cheyenne, sent by Governor Barber, carrying a United States marshal, robbed the mob of its anticipated pleasure, for which its appetite had been whetted by shooting through the cell window most of the night.

From Cheyenne he went to Silver City, New Mexico, where he made a rapid and complete recovery. Thereafter he married Miss Kathryn Drexel, of New York, and accepted the professorship of gynecology in the University of Pennsylvania. This department he organized and administered with his characteristic skill and thoroughness. His textbook on *Diseases of Women* was welcomed as a standard. He taught rational, clean, gentle surgery by word and hands in a way both convincing and proselytizing. He had the hero worship of his students, the confidence and respect of his colleagues, a large consulting and private practice, and a leading place among the surgeons of America.

A recurrence of his lung trouble forced him to resign all this and to devote himself to its arrest or cure.

To meet the obvious and urgent need of a hospital for women, Penrose founded, organized, incorporated, and, through his friends, financed the Gynecean Hospital (1887); having associated with him at first Dr. Joseph Price, then Drs. D. Hayes Agnew and J. Montgomery Baldy; the latter most ably carrying for many years the surgical and executive burden of the institution.

During the late war and thereafter, Penrose and Baldy, in the larger interests of public health and because the need seemed urgent, devoted the hospital to the sequestration, until rendered non-contagious, of venereally infected women sent by the Municipal Court. Room was made for sixty; a dispensary with an average attendance of one hundred was opened nightly for those not under court control. Threatened failure of the city to co-operate in more extensive plans having for their end the lessening of venereal incidence, led to the closing of the Gynecean Hospital in 1924. In accordance with Penrose's wish the interest from the Gynecean Estate of something short of a half million dollars has been devoted to research, now being conducted under the supervision of the genecological department of the University of Pennsylvania.

In 1903 he conceived and created the Pennsylvania Department of Health, giving to its commissioner extraordinary power. His conception was put in such impregnable legal phraseology by Mr. Eli K. Price that all attacks upon it have failed. Penrose saw personally every member of the legislature the night before the passage of his bill and named the first commissioner of health, Dr. Samuel G. Dixon. This might not have been possible except for the active support of his brother, Honorable Boies Penrose, then and until his death the dominant influence in both state and national politics.

In 1899, Penrose was appointed a member of the Game Commission of Pennsylvania[1], becoming its president in 1911. From the beginning of his service therein he was director of its policies.

Dr. Grinnell writes: "For a matter of twenty years Penrose was the leading man on the commission. He devoted to it more time and energy than all the others put together. No legislation was passed and nothing was done that he did not approve."

From the beginning of his direction of the Zoological Garden of Philadelphia, Penrose pursued the policy of making an exhibit unrivaled both in the variety of animals shown and in the maintenance of their health. He, with the assistance of Drs. William Pepper, M. T. Ravenel, C. Y. White, Leonard Pearson, and Herbert Fox, conducted autopsies from the findings of which the principles of preventive

[1]Pennsylvania now has thirty-four game refuges, containing about 30,000 acres surrounded by 1,200,000 acres of state forest, the latter available for hunting. Nearly 8000 deer, nearly 1000 bear, over a half million grouse, three to four million rabbits, several thousand turkeys, and other game birds and animals are annually shot by the nearly half-million licensed hunters of the state.

medicine were so applied that, among other betterments in animal health, tuberculosis in the monkey was practically abolished.

C. Y. White, the first pathologist, was succeeded by Dr. Herbert Fox, whose studies and publications have proved Penrose's belief that a zoological garden may be not merely an exhibit, but a school, having as its main function, contributions to science.

His struggle for health was amazingly successful. When after a period of intensive work his warning came, he hunted, fished, and explored; in the Rockies, the uplands of the South, once in Venezuela. After months of life in the open he came back well. In the spring of 1920 his warnings came and more urgent than ever before—he planned a longer trip than usual, but was held all that summer by the illness of his brother. Nights and days of unremitting care accomplished the impossible. None knew better than Charles Penrose that he was giving his own life for that of the Senator, and that when the time of rest came the sun and air could no longer bring back that which was so far spent.

A banker once spoke slightingly of Abraham Lincoln "because he left a small estate." Lincoln left a continent in peace and honor to now one hundred and ten million people. No larger legacy is recorded in history. Even from the narrow standpoint Penrose would have commanded the banker's respect. From the broader one, to many millions he left a longer life, a better health, forests, game in abundance, a zoological garden of first rank contributing largely to science, and a department of research.

Penrose was strikingly handsome, standing six feet and of powerful build. Till within a year of his death, he presented the color, bearing, and appearance of rugged health. He was unemotional, undemonstrative; on the birth of his son, a lady whose life he had saved and who spoke of him as having the face of Endymion, hands of velvet and the tread of a marching regiment, said: "Aren't you thrilled at the coming of Little Boy Blue?" He answered, "He is not a blue baby; I am not thrilled; but, of course, the young of all vertebrates are interesting."

With him all policies were subject to cold deliberation. When approved by reason they were followed by prompt action, the details of which were carefully planned and carried out with a tireless persistence which neither hurried nor delayed. He loved power, but never its display. He shunned publicity and condemned with extraordinary vigor of diction those to whom it came either by choice or chance. Law-abiding, he bitterly opposed the encroachment of national authority over that of the state; and the interference of both with individual rights and privileges.

He shot in perfect form, deliberately and with deadly accuracy. He was a good farmer and gardener; a good horseman; a good fisherman; an admirable host, skilled in cooking, exacting and securing the best; a good sailor. All things he did well; deliberately and efficiently.

On one of his hunting trips, while about to skin a grizzly which he had shot, he was rushed by another bear and severely clawed and bitten before he succeeded in killing it. His own clean surgery promptly applied saved his wrist joint from which the bones were protruding; and, probably, his life.

One hundred years from now a research fellow, passing through the hall of the medical school, may stop for a moment, arrested by the extraordinary beauty of a face painted by Julian Story with more than his usual richness of coloring and delicacy of touch: "Charles Bingham Penrose, professor of Gynecology, 1892-98." Intellect of a high order, strength, determination, ability; all these the artist has written for the reading of those to come. The Fellow may ask why has such a one left no record other than of his brief professorship; little realizing that rich legacy, in which he himself at that moment is sharing, a legacy which grows with the passing years.

EDWARD MARTIN.

Born, 1862. Married, 1892. Died, 1925. A.B., 1881. A.M., PH.D., 1884 (Harvard). M. D. (class president) 1884, D.Sc. 1910 (University of Pennsylvania). Resident physician, Pennsylvania Hospital, 1885–86. Founder and surgeon of Gynecean Hospital, 1887–99. Surgeon to the German Hospital, 1890. Professor of gynecology, University of Pennsylvania, 1893–99. Retired from active practice, 1899. Member of the Phi Beta Kappa Society, College of Physicians of Philadelphia, American College of Surgeons, American Philosophical Society, Academy of Natural Sciences, Park Commission of Philadelphia, American Association for the Advancement of Science. President of the Zoological Society of Philadelphia, president of the Game Commission, Commonwealth of Pennsylvania. Member of the Pennsylvania Society of Descendants of Colonial Governors; Harvard Club, The Union League, the Philadelphia Club, The Racquet Club, Corinthian Yacht Club, Radnor Hunt Club, University Barge Club, The Rabbit, The Jury, Principio Gunning Club, Maryland; Henry's Lake Club, Idaho; Sand Bridge Club, Virginia; Mud Hole Meadow Club, New Jersey; The Wilderness Club; The Boone and Crockett Club.

Medicæ artis principes,

poſt Hippocratem & Galenum.

Græci Latinitate donati,

Aretæus,
Ruffus Epheſius,
Oribaſius,
Paulus AEgineta,
Aëtius,
Alex. Trallianus,
Actuarius,
Nic. Myrepſus.

Latini,

Corn. Celſus,
Scrib. Largus,
Marcell. Empiricus.

Aliique præterea, quorum unius nomen ignoratur.

Index non ſolùm copioſus, ſed etiam ordine artificioſo omnia digeſta habens.

Hippocr. aliquot loci cum Corn. Celſi interpretatione.

Henr. Stephani de hac ſua editione tetraſtichon.

Quærere quos ægri per compita multa ſolebant,
Hoſpita nunc per me eſt omnibus vna domus.
Prima ſaluiſsem medicorum gratia dextræ:
Siſtenti medicos nónne ſecunda mihi?

ANNO M. D. LXVII
Excudebat Henricus Stephanus, illuſtris viri
Huldrichi Fuggeri typographus.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

THE CHIEFS OF THE ART OF MEDICINE, BY HENRI ESTIENNE

THE publication of the *Medical dictionary* by Henri Estienne in 1564 apparently did not satisfy his urge for medical editing. He had spent seven years going over and collating the manuscripts of many writers and as the result of this immense labor had produced a small book which, though not voluminous, stood as the greatest triumph in medical nomenclature extant at this time. The book must have seemed too small to represent all this work and added to this thought or idea there may have been the further desire to excel his great competitor, the Aldine Press, which had in 1547 published its beautiful edition of the *Collected Works of the Ancient Medical Writers*. A comparison of dates makes one wonder whether the Aldine edition was not the primary cause of Estienne's starting on the dictionary, for he says he worked on it seven years and the two books were published that many years apart. Further, the authors studied and published in the two works conflict very seldom and the list of Estienne contains the greater names of the two.

Whether or not the speculation as to reason is true, the fact remains that in 1567 Estienne published in full the works of the authors whose medical terminology he had elucidated in his dictionary. The work comprises two great folio volumes and was printed as was the dictionary with the help of Huldrich Fugger who was still apparently financing the press.

There was a certain amount of publisher's jealousy behind the printing of these works, for in the preface to the volumes Estienne is most uncomplimentary to the rival printing house of Aldus which had published Latin translations of the works of Aetius of Amida and Paulus of Aegina both of whom Estienne includes in his collection. In fact the introduction to the preface which is in the form of a letter to his friend William Plancius is written in a rather polemic vein. He begins by saying that if any one asked him what he had to do with medicine or Hippocrates or Aesculapius or any other medical affairs he would answer as did Terence, that he was a man and considered himself only human. Evidently inferring that he was interested in the subject and would be perfectly satisfied if others minded their own business. When he refers to the Aldine publications he becomes really insulting for he says, "what other therefore is the edition of Paulus of Aegina and Aetius which is produced by the heirs of Aldus than a foul collection of all forms of errors." He goes on to say that some of the mistakes are imputed to typographical errors and some to mistakes and imperfections in the original text. He then says that in his edition he has corrected all of the errors that can possibly be corrected. After the unpleasant portion of the preface the editor goes on to describe the book and its arrangement with special reference to the index and finally dedicates it to his friend Plancius.

Estienne has made a most excellent selection of authors for his volumes which contain a veritable mine of information about ancient medicine. The authors chosen represent the best in medicine of the Roman and Byzantine periods and the wording of the title page is not at all too far fetched when it says: "The Chiefs of the Art of Medicine after Hippocrates and Galen." The volumes contain the works of these authors rendered into Latin by the famous scholars of the period and the whole is edited by Estienne. The works of Aretaeus and Ruffus are translated by Crassus, who writes his own dedication to Albert, Prince of Brandenburg; John Guinter of Andernach translates the work of Alexander of Tralles and dedicates it to Prince William of Hess; Janus Cornarius interprets Paulus of Aegina and Aetius of Amida and adds many pages of explanations of his translations; and so on through the two folio volumes.

A very interesting portion of the second volume for the surgeon is the translation of the works of Oribasius on nooses (knots) and machines by Vidus Vidius of Florence. Vidius had published his surgery in 1543 while he was in Paris and included much of the work of Oribasius. In the fragments in this volume he gives the two works as noted above and illustrates them profusely with beautiful woodcuts but unfortunately does not give the illustrations of bandages. The illustrations of the machines used in the reduction of fractures and dislocations differ from those in Vidius' earlier work and on the whole are clearer though not so artistic. The nooses or knots used for traction are very ingenious and show various methods of getting pull on the different parts of the extremities without constriction which are as valuable today as in the early days of surgery and would well repay careful study with the object of present day use in mind.

REVIEWS OF NEW BOOKS

THIS book is a second edition of the well known work on the subject of X-ray diagnosis of gastro-intestinal diseases by E. Stierlin[1] which, for many years, has been a foremost book in X-ray literature. Chaoul has greatly enlarged the work, and the result is a book of greatest detail and thoroughness in presenting the clinical X-ray phases of this special diagnostic work. The large volume is replete with illustrations that are clear and with text that is in keeping with the work of a master. Chaoul, who is a professor in the University of Berlin, dedicates the book to Sauerbruch who writes an introduction. The author spent many years in association with Stierlin in Basel, Munich, and Berlin which should make him pre-eminently the one to revise, enlarge, and bring up-to-date the original work on which the present book is based. The subject matter is presented in not only the X-ray aspect but also in its anatomical, physiological, symptomatological, and pathological phases. Especially noteworthy is the work on studies of X-ray shadows of the gastric mucosa, the folds and markings of which are presented most admirably. This is done with the use of exceedingly small quantities of the opaque medium and special external pressure to thin the material between the anterior and posterior gastric walls by which maneuver small lesions of the mucosal surfaces are detected. One can but express the wish that this splendid German work could be made available to English reading physicians. E. S. B.

AT last! Koehler's book[2] in English! Roentgenologists conversant with German X-ray literature have often repeated the wish that this book should be available to those who read only English. Koehler's original book was published in 1920, went through several editions, and proved indispensable to many X-ray workers. This English version will be eagerly welcomed and will give much satisfaction to the many who know of the great value of the original work but who had not been able to use it as it was written in German. The book gives one the benefit of the accumulated experience of one of the world's leading masters in roentgenology and it contains many excellent illustrations and diagrams. The original work has been greatly enlarged and amplified.

One notes that the title of this English book is "Röntgenology," the German spelling being used. This seems to be adding another variant to the already too numerous terms used in the X-ray art at a time when serious efforts are being made to reduce the terminology. It has the advantage of eliminating one letter from the English equivalent, "Roentgenology." The author is conservative in his statements, which is commendable in these days when X-ray writers do not always give out mature opinions. The material given is up to date, but Koehler does not bring in X-ray procedures untried or unproved. The Graham gall bladder test is accorded a very brief presentation. This, of course, does not detract from the value of the book. The heart and aorta are given considerable space, and there is a satisfactory exposition of the X-ray knowledge in the gastro-intestinal tract, the urinary system, and abdominal and pelvic conditions. The book contains what is probably the best exposition of the diagnostic features of bone and joint conditions that has appeared to date, and its particular and peculiar value lies in the specific descriptions of shadow complexes that are abnormal in appearance but are definitely not pathological in significance. A most commendable feature in the manner of presentation of anatomical parts is the fact that the author starts from the fingers and toes and proceeds upward so that the searcher can quickly locate the text that covers a particular region. Note is made of the author's extended exposition of the peculiar lesion which involves the head of the second metatarsal bone to which his name has been attached and over which there seems to be considerable debate.

As the book treats of "the borderlines between normal and pathological," it contains fewer frank and advanced lesions than is usual in most books on the subject of X-ray diagnosis, and there are no sections that deal with any one type of lesion, the various lesions being found distributed throughout the book under the various special anatomical parts. The student of X-ray diagnosis who follows the material given in this book will make few errors of interpretation. The many variations of the normal which one encounters almost daily are puzzling even to roentgenologists of large experience who, too, will find the book an indispensable addition to their libraries. Fraser states in a preface to the English edition: "This book is a veritable mine of information," and Case, in his preface to the American edition, says: "Koehler's monumental book supplies the data on which a decision may be safely based."

This book can be recommended without reservation as an authoritative work on the borderline between the normal and pathological in X-ray diagnosis. E. S. B.

ROQUES' monograph on *Epidemic Encephalitis in Association with Pregnancy, Labour, and the Puerperium*,[3] is well written and very instructive.

[1] E. STIERLIN'S KLINISCHE ROENTGENDIAGNOSTIK DES VERDAUUNGSKANALS. 2d. fully rev. ed. By Dr. H. Chaoul. With a Foreword by Ferdinand Sauerbruch. Berlin: Julius Springer, 1928.

[2] RÖNTGENOLOGY; THE BORDERLANDS OF THE NORMAL AND EARLY PATHOLOGICAL IN THE SKIAGRAM. By Alban Koehler. Rendered into English from the Fifth German Edition by Arthur Turnbull, M.A., B.Sc., M.B., Ch.B. (Glasg.). New York: William Wood and Company, 1928.

[3] EPIDEMIC ENCEPHALITIS IN ASSOCIATION WITH PREGNANCY, LABOUR, AND THE PUERPERIUM. By Frederick Roques, M.A., M.D., M.Chir, (Cantab.), F.R.C.S. (Eng.). Manchester: Sherrat & Hughes, 1928.

The author reports 40 cases collected in England and 171 cases collected from the literature.

The subject has been treated in an exhaustive manner, each subdivision being fully discussed and substantiated by tables of statistics.

The reviewer can give only a brief résumé of the conclusions reached, which are as follows: The course of acute epidemic encephalitis is not altered in a woman by the fact that she is pregnant. Evacuation of the uterus seems not to improve the patient. The disease does not ordinarily produce abortion. In the majority, pregnancy is wont to proceed to term. Labor is usually painless. The infants are healthy at birth and remain so in a large percentage. Encephalitis epidemica neonatorum is a definite clinical entity although rare. The infection seldom passes via mother's milk.

Parkinsonism is a frequent complication following encephalitis, and pregnancy makes the patient worse as a rule. Therefore, patients should be advised not to become pregnant until a lapse of 4 years from the recovery from encephalitis. EDWARD L. CORNELL.

FOR many years F. Sauerbruch's *Chirurgie der Brustorgane*[1] has been the outstanding work in surgery of the chest, as far as wealth of subject matter and illustrations are concerned. Appearing first in a single volume in 1911 when the field of chest surgery was small, the *Chirurgie der Brustorgane* has enlarged as the field itself has grown. In 1920, the second edition, a two volume work, was published. The first part of volume one of the third edition has reached the hands of the reviewer.

For those who are not familiar with the second edition of *Die Chirurgie der Brustorgane* it should be said the subject of chest surgery is covered from beginning to end in a painstaking, thorough, and masterful way. Anatomy, physiology, pathology, diagnosis, and technique of all the pathological conditions of the chest which lend themselves to surgical treatment are discussed completely and minutely. The illustrations which number in the neighborhood of fifteen hundred are of several types; photographs, drawings, diagrams, reproductions of roentgenograms, and lastly, some of the most beautiful colored plates the reviewer has seen in surgical text books. The diagrams and photographs and plates are extremely helpful to the reader and in themselves would stamp the work as one of the outstanding medical treatises.

Although the work is uniform throughout, it comes from the pens of several authors.

The text is clear, the subject matter is easy to find, and an excellent bibliography is appended. The second edition of this work is the international classic on chest surgery.

Now appears edition number three of which only the first part of volume one has been received by the reviewer.

Volume one part one contains 907 pages and 916 illustrations. In form and general construction it resembles its predecessors. Many of the plates of the latter have been used. However, much has been added, for example, the subject of lung mapping by means of the intrabronchial instillation of roentgen opaque matter which was not dealt with before, is now covered.

Volume one deals chiefly with general subjects, anatomy, physiology, general pathology, and general technique; a few special subjects are covered.

In short, Sauerbruch's *Chirurgie der Brustorgane* is being brought up-to-date to cover the rapidly growing field of chest surgery, and evidently, when the third edition is completed, will maintain its place as the standard treatise on the subject. R. B. B.

[1] DIE CHIRURGIE DER BRUSTORGANE. By Ferdinand Sauerbruch. 3d ed. Vol. 1—Die Erkrankungen der Lungen. With the collaboration of H. Alexander, H. Chaoul, and W. Felix. Part I—Anatomie, allg. pathologische Physiologie, allgemeine Diagnostik, allgemeine Technik, Erkrankungen der Brustwand, Verletzungen von Brustfell und Lungen Bronchektasen, Operation der Embolie der Lungenarterien. Berlin: Julius Springer, 1928.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE TREATMENT OF FRACTURES. By Lorenz Boehler, M.D. Authorized English translation by M. E. Steinberg, M. S., M.D. Vienna: Wilhelm Maudrich, 1929.

RADIUM TREATMENT OF CANCER. By Stanford Cade, F.R.C.S.(Eng.). New York: William Wood & Company, 1929.

AN INTRODUCTION TO THE STUDY OF PHYSIC (Now for the First Time Published). By William Heberden (1710-1801). A Prefatory Essay by LeRoy Crummer, with a Reprint of Heberden's Some Account of a Disorder of the Breast. New York: Paul B. Hoeber, Inc., 1929.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. Vol. xii.—Pathology of the Acute Respiratory Diseases, and of Gas Gangrene Following War Wounds. Prepared under the Direction of Maj. Gen. M. W. Ireland, the Surgeon General. By Maj. George R. Callender, M.C., and Maj. James F. Coupal, M.C.

THE ART OF SURGERY; A TEXT-BOOK FOR STUDENTS AND PRACTITIONERS. By H. S. Souttar, D.M., M.Ch. (Oxon.), F.R.C.S. (Eng.). New York: Paul B. Hoeber, Inc., 1929.

LA PRATIQUE CHIRURGICALE ILLUSTRÉE. Vol. xiv. By Victor Pauchet. Paris: Gaston Doin et Cie, 1929.

THE AUTONOMIC NERVOUS SYSTEM. By Albert Kuntz, Ph.D., M.D. Philadelphia: Lea & Febiger, 1929.

DIAGNOSIS AND TREATMENT OF DEFORMITIES IN INFANCY AND EARLY CHILDHOOD. By M. F. Forrester-Brown, M.S., M.D. (Lond.). With a Foreword By Sir Robert Jones, Bart., K.B.E., C. B., F.R.C.S. New York and London: Oxford University Press, 1929.

AMERICAN COLLEGE OF SURGEONS

A GROUP OF SECTIONAL MEETINGS OF THE AMERICAN COLLEGE OF SURGEONS

INTRODUCTION BY BOWMAN C. CROWELL, M.D., ASSOCIATE DIRECTOR

IN addition to the annual Clinical Congress of the American College of Surgeons, which is held in the larger clinical centers, it has been the custom of the College to hold sectional meetings in various parts of the country each year.

These meetings offer to many who are unable to attend the Clinical Congress an opportunity for visiting clinics, for discussion of hospital and scientific problems, and for closer personal contact than is possible at the larger Annual Clinical Congress. They also offer an opportunity for informing the public on matters pertaining to health and disease.

The general plan of these meetings is to hold sessions during two days. Clinics are held in the local hospitals, a scientific program is presented by the surgeons of the section, hospital standardization meetings are held under the direction of the director of hospital activities, business meetings of the Fellows of the College take place, and a public meeting is held during one evening.

At this public meeting the speakers are men of national prominence who address the audience often with illustrated lectures on matters pertaining to hospitals and the personal health of the people. Such subjects as cancer, goiter, pre-natal care, scientific medicine, and personal health examinations are frequently topics of discussion.

In 1929, sectional meetings were held in Phoenix, Arizona; Los Angeles, California; Vancouver, British Columbia; Regina, Saskatchewan; Winnipeg, Manitoba; Minneapolis, Minnesota; and Lincoln, Nebraska. In addition to these meetings some of the traveling group met with local county medical societies where they presented a program and visited hospitals in El Paso, Texas; San Diego and San Francisco, California; Portland, Oregon; Seattle, Washington; and Omaha, Nebraska.

Among those who attended the entire group of meetings were Dr. Charles L. Scudder of Boston, chairman of the Committee on the Treatment of Fractures, Dr. Burton J. Lee, New York, member of the Committee on the Treatment of Malignant Diseases with Radium and X-ray, and Mr. Robert Jolly, Houston, Texas, superintendent of the Baptist Hospital. The diaries of these three gentlemen follow this brief introduction.

REPORT OF CHARLES L. SCUDDER, M.D., CHAIRMAN OF THE COMMITTEE ON THE TREATMENT OF FRACTURES OF THE AMERICAN COLLEGE OF SURGEONS

Through the courtesy extended to me as chairman of the Committee on the Treatment of Fractures of the American College of Surgeons, I was permitted to accompany officers of the College on an official trip through the western states in the spring of 1929. It is an honor and privilege to make a brief report of the impressions and observations gained on that journey. I attended these meetings primarily (1) to gain information regarding the fracture situation in the parts visited; (2) to stimulate further interest in fracture treatment; and (3) to appoint subcommittees to serve as regional committees on the treatment of fractures.

In general I may say that the whole series of meetings was wonderfully well planned. The itinerary had been worked out so that rarely were we obliged to travel successive nights by train. The hotel accommodations were always comfortable and adequate, the best. Local men conducted clinics and participated freely. The meetings—clinical, scientific, and public—had been well advertised and were well attended by keenly interested men and women. The programs as educational factors certainly fulfilled the fondest hopes of those in charge. Scientific meetings with papers and demonstrations contributed to the variety of the program. The hospital conferences, at which doctors, laymen, trustees, and sisters mingled, were vital meetings at which practical hospital problems were discussed and at which questions were raised and answered. These hospital conferences, under the remarkable leadership and support of Dr. Malcolm MacEachern and with the stimulating assistance of Mr. Robert Jolly, of Houston,

Texas, were conducive to real progress. All hospitals in each community were visited.

I was impressed by the tremendous going capacity for accomplishment of the active organization of our American College of Surgeons. Those of us who live east of Chicago little realize the problems of the physician in the middle, southern, and northwestern United States and Canada, and how the College is meeting these problems. I believe that the sectional meetings, the community health meetings, the clinical meetings, and the hospital conferences of our American College of Surgeons—all these College activities as conducted—are productive of great good. Moreover, these meetings are appreciated—physicians and surgeons attend, take part enthusiastically, and say that they receive benefit from them. I have been impressed by the great efficiency of the machinery of the College to function in an educational way, and I believe that the results as regards the general uplift of the profession will endure.

Where no sectional meetings were held, we attended clinical meetings of county societies: at El Paso, Texas; San Diego and San Francisco, California; Portland, Oregon; and Seattle, Washington.

At each place, in presenting the subject of the treatment of fractures, I attempted to become familiar with local conditions through answers given to the following questionnaire:

Who is taking care of fractures?
Who is doing the industrial accident work?
Who is interested in fractures in the various hospitals of the city?
Is the workmen's compensation act well administered?
Are there malpractice suits because of poorly treated fractures?
What is the special type of fracture seen in this community?
Is any one doing research on fractures?
Is the orthopedic surgeon interested in fractures?
What kind of work is he doing?
Are there established fracture services in hospitals?
Is there a well equipped splint room in the hospital?
Does the teaching center have any effect on service rendered the fracture patient?
What is the effect of the open hospital on fracture treatment?
Do standards of results vary?
What is the status of the operative treatment?
Are general practitioners interested in fracture treatment?
Are general surgeons interested?

The answers to these questions put me in touch with the fracture situation in each locality. The questions were not always answered completely but their presentation led to discussion and to the gleaning of information.

The meeting at El Paso, Texas, not only presented the local situation, but, through the cooperation of Dr. Miller, the president of the Texas State Medical Association, opened the way to the appointment of tentative committees in fracture work in the towns of the great state of Texas. It is my hope to be able again to visit Texas and to confirm the interest said to exist in fracture treatment in that state.

Impressions gained

Interest in the treatment of fractures is growing through this western country.

The general surgeon is interested only exceptionally. Very few surgeons are competent to handle all fractures and all their complications.

The man practising orthopedics is interested outstandingly in fracture treatment.

A great deal of personal experimental work is being done. Technique is being used which is not methodical and is without sound foundation—methods which have been found inadequate and unsatisfactory in other localities. Insufficient traction methods are being employed. Operative replacements are too generally resorted to. The indications for the use of the operative treatment are not clearly defined.

The surgeons are well informed concerning pathological processes and are well versed in the indications for the surgical treatment of such lesions.

There is no general body of knowledge of the fundamentals of fracture treatment. The anatomical result of the attempted reposition of a fracture serves often as the only basis for treatment. In certain sections the desire to secure an exact anatomical result as indicated by the X-ray is the basis for an early operative replacement. This attitude is urged because, should there be a trial in court, the decision of the court is based largely on the exactness of the reduction, rather than on the amount of function of the part.

The centers which have teaching hospitals and a moderately closed or controlled hospital staff are as a rule doing the best work. A wide open hospital is not conducive to sound work in surgery, particularly in fracture surgery.

Personal jealousies and rivalries exist as in every community, East or West, and are allowed to influence progress.

A tendency is found to ignore and not to help the younger men of the profession to positions on the staff of hospitals. The older men tend to hold on to staff positions and appointments beyond a useful period. I think that there is a failure to recognize the fact that after a certain time the experience obtained by hospital contacts will carry the surgeon along and that relinquishing that official relationship to the coming generation reacts well on both the older and the younger group.

As to the present methods of treating fractures it may be said that information regarding fracture treatment is noticeably lacking in uniformity. The generally accepted bases for treatment are not always recognized. As a result, experimental forms of treatment are duplicated to the detriment of both patient and physician.

In certain fractures of the long bones, it is pretty commonly understood that skin traction with a small weight gradually increased will not be effective. Despite this fact I found this inadequate and obsolete form of treatment many times in

use. Obviously, dissemination of information on this point through the local regional committees recently formed will do away with this inefficient procedure and be the means of substituting therefor a better method. One of the important contributions of the fracture committee to progress is the dissemination of knowledge of achievements along all lines of treatment. A very important reason for establishing regional committees is to have available men in the different sections of the country to whom we may send our findings.

At the Hospital Conferences stress was laid by me upon—

a. The importance of the hospital management becoming familiar with results of the treatment of fractures by members of its staff. Familiarity of the hospital management with the results of fracture treatment would mean that results must be determined.

b. A follow-up is thus necessary. The results will be good, poor, or bad. This knowledge will help to determine whether the staff is efficient.

c. The organization of a social service is a prime essential for the hospital. Such social service work need not be complicated and may be quite simple. I dwelt upon the function of medical social work on a fracture service such as:

1. Interviews with all fracture patients admitted to wards: (a) to discover any obstacles in patient's personal or family situation that would hamper continuity of treatment; (b) to explain fully to patient what good end-results mean in terms of the patient's part in carrying out after-care plans, and the limitations of skilful treatment in cases of severe injury; (c) to explain clinic follow-up; what the doctor wants the patient to do, and why.

2. Medical social service to patients who need social treatment at this stage, to assure their benefiting by the treatment.

I presented the following details:

1. Complications of fractures familiar to the medical social worker: (a) fear of hospitals; loneliness, unwillingness to endure temporary discomfort for the sake of better end-results, all tending toward discharge against advice; (b) psychological reactions which undermine patient's self confidence and produce incapacity; (c) financial distress due to cutting off of wages while family responsibilities continue; (d) homelessness without savings; (e) homes unsuitable for convalescent care; (f) entire dependency due to complications of old age or chronic disease; (g) inability to return to former occupation as result of the fracture.

2. Social service work in the hospital may help to get satisfactory end-results in fracture cases by: (a) influencing attitudes of patient and family to secure co-operation with doctor's plan of treatment; (b) studying patient's personality and securing pertinent social history to throw light on his reactions and to motivate treatment; (c) adjusting the hospital routine to the needs of the helpless and easily discouraged patient, and getting him regularly to the right doctor at the right time and place; (d) obtaining adequate financial assistance to cover loss of wages; readjusting hospital rates; financing apparatus; (e) planning after-care of patient, in his home or elsewhere (i.e., convalescent home); arranging for service of visiting nurse when necessary; (f) re-educating patient for work within his capacity; (g) acting as liaison officer between patient's private physician and the hospital staff in working out plan for after-care.

These social service notes have been practically worked out and have been found useful by the Social Service group of the Massachusetts General Hospital in Boston.

During this trip some twenty regional committees were appointed.

These small groups of men selected from those interested in fracture work will be the means of (1) maintaining local fracture interest; (2) conducting fracture clinics and meetings; (3) organizing teaching demonstrations; (4) keeping in touch with the general fracture committee; (5) receiving and locally broadcasting bulletins issued from time to time by the general committee; and (6) co-operating with future visiting delegations from the general fracture committee.

In conclusion, it may be stated that my visit through the western states served definitely to secure a knowledge of fracture treatment by bringing into view present practice; by informing the profession of the work of the College through its fracture committee to improve treatment; by assembling interested individuals who may develop a mutual understanding of needs; by establishing groups to concern themselves with progress and the output of the Committee contacts; by stimulating interest in fractures directly by personal appeal; by sympathetic personal approval or criticism of work in progress; by assistance in establishing fracture services in the larger hospitals according to local conditions.

Such contacts as are made by attendance on these clinical meetings, if repeated with regularity, will serve in a large measure gradually to improve fracture treatment.

REPORT OF DOCTOR BURTON J. LEE, REPRESENTING THE COMMITTEE ON THE TREATMENT OF MALIGNANT DISEASES WITH RADIUM AND X-RAY

An opportunity was afforded me, as one of the clinicians participating in the sectional meetings to observe the activities of the College from an entirely new viewpoint, and the reaction of surgeons and the public to the program provided. I had had little appreciation of the extensive educational work which was being carried out by the College in connection with these sectional meetings, nor the necessity for the organized effort in hospital standardization.

In all the cities visited, the medical staffs of hospitals attached great importance to the hospital standards set up by the College. The conferences held by Dr. MacEachern were always largely attended, as many as three hundred people being

present at one session. These meetings attracted doctors, hospital superintendents, members of the nursing staffs, social service workers and record clerks. The meetings were well conducted and many interesting demonstrations were held, giving rise to subjects for discussion. This department of the College has done much to improve the quality of hospital service and make more effective the clinical and research work of the staffs. The insistence upon adequate and well kept records in standardized hospitals was repeatedly emphasized, as well as the maintenance of the highest ethical standards. The necessity for staff conferences at regular intervals was stressed, that the entire work of the staff might be reviewed and critically analyzed.

For many years, we have been convinced that the management of the cancer problem throughout this country, and in Canada, was helter-skelter and everybody's business, for in but few places was there any intensive focus upon the subject. In some of the larger cities, cancer institutes had already been gained through my association with the Memorial Hospital of New York during the past ten years. I knew that there were well organized institutions for the study and treatment of cancer and for research in this field, located in Montreal; Boston; Philadelphia; Baltimore; St. Louis; Minneapolis; Rochester, Minnesota; Atlanta; Buffalo; and New York. There is also the Crocker Institute in New York City devoted entirely to the research phases of the problem. We, who have worked intensively in special cancer institutes, feel certain that the problem can be handled effectively only when a group of men unite to study the clinical and research aspects of the subject. I am convinced that no individual should depend solely upon himself in making a diagnosis of carcinoma, nor determine the treatment to be used. This is a task requiring a joint judgment of surgeons, pathologists, radiologists, and internists. When such a group attempts a diagnosis, the bias of any individual is minimized and a more correct estimate of the case is made. Moreover, the leaning of any individual toward a special type of treatment is carefully checked and, in general, the best line of therapy chosen for each particular patient. In such an institution the contact of the clinical group, with laboratory research workers stimulates a scientific interest in the subject of cancer.

It was evident that in many of the cities which we might visit a cancer institute could not be organized. In these cities, it seemed practicable to assemble groups of men, each group to contain several surgeons, a pathologist, a gynecologist, a urologist, a radiologist, and a competent internist. These men would join together with the object of making better diagnosis upon cancer patients; to outline and carry out proper forms of therapy; and to encourage clinical research in this important field. Dr. Crowell told me that he had had this same idea in mind for some time and was in full accord with the proposed effort.

Method of Procedure

The general plan of procedure in each city which we visited was as follows:

As soon as possible after our arrival, I saw the chairman of the local committee and asked him to select the men in the community best fitted to form a cancer group. I also requested him to choose a convenient time when Dr. Crowell and I might meet with these men and explain the necessity for such an organized effort. In the meantime, I made it my business to meet and become acquainted with the men in the community, visiting them in their hospitals and seeing some of the operative work which was being done. In every city which we visited, I saw, in consultation with the members of the profession, numerous cases of cancer, the total number approximating one hundred. Many of these patients were seen after the evening meetings.

In the cities in which sectional meetings were held, namely, Phoenix, Los Angeles, Vancouver, Regina, Winnipeg, Minneapolis, and Lincoln, I conducted a cancer clinic, presenting patients furnished by the doctors in the community. The plan followed was to have the doctor present the patient. Then I made a few brief comments upon the case from the standpoint of diagnosis and treatment, using the patient as a text to emphasize some important points. At one or two of the later clinics we were able to obtain pathological autopsy material and conduct, with the aid of pathologists present, a brief clinico-pathological conference. These clinics occupied, as a rule, but one hour, for it seemed best to make them short and concise, closing the clinic promptly. At practically all of the cities visited, I presented a paper, with lantern slides, upon "The Indications for Surgery and The Indications for Irradiation in the Treatment of Cancer," this paper being presented invariably within a thirty minute limit. In addition to these activities, at several County Medical Society Meetings, I presented a paper entitled "A Clinical Index of Malignancy for Cancer of the Breast," with lantern slides, the talk consuming twenty minutes—but no more.

The public meetings, held in the evening, attracted large audiences; on one occasion over two

thousand being present. Always an atmosphere of friendliness pervaded the meetings. The session began promptly at eight o'clock and closed at ten o'clock. There were seven or eight short addresses, giving a large amount of valuable information to the public concerning the preservation of health and the control of disease. This particular activity of the College has the highest educational value. The audience was informed as to the need of adequate hospitalization for their community, the meaning of the term "Standardized Hospitals" and the necessity for staffing the hospitals with competent ethical surgeons. Dr. Crowell emphasized the important advances in modern medicine, and at some of the meetings other papers of a similar sort were presented, setting forth in terms that the public could understand the accomplishments of medicine in recent decades. I gave a fifteen minute talk entitled: "What Can You and I Do About Cancer?" I stressed the optimistic side of the subject by pointing out that many types of cancer are preventable and that early cancer, in many instances, is curable.

The clinicians participating in the trip presented papers at the scientific sessions, gave practical clinics and addresses at the public meetings. Besides these activities, Dr. Crowell, of the department of clinical research, and I took the first steps in organizing clinical and research facilities throughout the country in behalf of cancer patients.

At the appointed hour, Dr. Crowell and I held our conference with the men chosen and outlined briefly the necessity for cancer organization in their community. The plan was heartily received everywhere and there was unanimous accord that provision should be made for better care of patients afflicted with cancer.

The first step to be taken was the organization of a conference for consultation with members of the group on cancer patients, the presentation of end-results, good and bad, and the exhibition of interesting pathological material. Special history forms prepared by our committee are to be furnished to the various cancer units, with the request that they return the completed histories to the American College of Surgeons. If nothing more than this were possible, it was termed a cancer group.

In some cities additional diagnostic and therapeutic facilities were available, and it was feasible to organize an out-patient clinic. Such an organization, we termed a cancer clinic.

If, in addition to the conference and the out-patient clinic, hospitalization, a physical department, and a research laboratory could be initiated, a cancer institute was formed.

Organization was effected by election of a chairman, vice chairman, and secretary, nominations having been made in open meeting. It was agreed that additional men could be added to the temporary committees, depending upon the needs of the community. Permanent organization is to be effected by the Board of Regents of the College at their annual meeting.

San Diego, Cancer Clinic. In San Diego, it seemed the psychological moment to start a cancer clinic. The group of men thought it was feasible to organize immediately for work, and to establish a weekly conference in the Out-Patient Department, where cancer patients could be studied and treated.

A letter of March 18 just received from the secretary of the cancer clinic, shows the progress already made in San Diego.

"You will no doubt be glad to know that the organization for the cancer work in San Diego is well advanced. We have formed a committee which is very representative, and last Saturday and our first conference at the County Hospital reviewing eight diversified malignant cases.

"Everyone seems to be highly enthusiastic so that the future seems distinctly bright."

Los Angeles. The best plan here seemed to be the organization of two cancer clinics, one at the California Hospital and the second at the County Hospital. The material coming from these clinics would be valuable, and furthermore a proper evaluation of Dr. Percy's work should be made by the College.

Santa Barbara. I left Los Angeles by motor on the evening of February 19, driving to Santa Barbara where I spent the night. The following day, we visited the Cottage Hospital, which seemed an excellent plant. I was much impressed at the entrance of the Hospital to see on a small mahogany desk close to the door the word "Hostess," which seemed a friendly greeting to a patient entering this institution. Considerable cancer research is being carried on in this hospital with a well equipped animal house

San Francisco, Cancer Institute. In San Francisco we were delighted to find that a new cancer institute had just been organized. Money has been provided through the Board of Health Budget to carry on the work of the institute. Three men are to make a trip this spring to various cancer institutes to study methods and organization and to obtain, if possible, a full time director for the institute. Much is to be expected from their efforts, as the men are earnest and the whole medical background in San Francisco is

healthy and refreshing. It is interesting that the San Francisco group had, themselves, made the decision to organize a cancer institute. At both the University of California and Stanford Medical Schools, I had a pleasurable visit with the laboratory men and was impressed with the high type of research in both of these institutions. It is planned to make the cancer institute a headquarters and collecting agency for cases of carcinoma for both the Stanford and University of California units.

Portland, Cancer Clinic. In this city we were pleased to find that a cancer clinic had already been organized at the Good Samaritan Hospital and had been in existence for one year. The clinic is held every Monday morning in one of the top floors of the building in rooms assigned for these purposes and adjacent to a modern X-ray plant, covering diagnosis and therapy. This group is earnest and considerable may be expected from it.

Vancouver. We met a representative group of men in Vancouver and had our usual talk with them. There was an unwillingness to organize any cancer group in Vancouver without conference with the Vancouver Medical Society. It was therefore decided that the representative of the American College of Surgeons in Vancouver, should confer with the members of the Vancouver Medical Society on the matter and that we should communicate with him concerning the organization of the cancer group.

Winnipeg, Cancer Institute. Here we were able to gather together, in the Library of the Medical Arts Building, a very unusual group of men including representative clinicians and physicists from the University. Great interest was shown concerning the formation of a cancer institute. It appeared feasible to establish a radium emanation plant through the co-operation of the Department of Physics of the University. An informal vote was taken and it was decided that the Dean of the Medical School should name a committee to organize and carry on this work. From the side of the American College of Surgeons, we promised that we would send them at the earliest possible moment, a plan of organization for the conduct of a cancer institute in Winnipeg. Much is to be expected from this city in the attempt at cancer organization, for one could seldom meet a more earnest, attractive group of professional men.

Minneapolis, Cancer Institute. Here a cancer institute has been in existence for the past three years. The physical plant is excellent with adequate facilities for out-patient work and an excellent X-ray equipment, and hospitalization is provided for upward of thirty patients.

Omaha, Cancer Group. Although Omaha was not on our schedule, I left Lincoln on March 16, early in the morning, by train to Omaha. There I presented a paper to the third and fourth year students of the University of Nebraska Medical School and also emphasized the necessity for careful anatomical training and refined surgical technique in the treatment of cancer. Later, I addressed the group of medical men who meet weekly at the University Hospital, repeating the paper which had been given to the students. After this meeting, I met the men interested in the formation of a cancer group.

Those present agreed that three vice chairmen should be chosen by the officers, one from each of the important hospitals in the city of Omaha.

A report of such a trip could not be complete without a comment upon the type of surgery done in the cities visited. Everywhere I saw well done surgery, the operators showing a background of fundamental surgical knowledge and demonstrating over and over again the highest technical skill. Few surgeons in the eastern part of the United States appreciate the expert surgery that is being done in all parts of the country.

Details Incident to Cancer Organization

Conferences. In each instance where an organization was effected, the men agreed to conduct a conference, preferably to be held each week. At these conferences, cancer patients were to be presented by members of the group and also by other physicians in the city and adjacent country. This will necessitate a careful history before presenting the patient and will make for better history taking. The presentation should be followed by a frank discussion concerning the diagnosis and the proper treatment to be applied. The cancer patient will, therefore, have the advantage of free consultation from members of the entire group. Furthermore, the conference will furnish an opportunity for each man to see many of the cases of cancer occurring in the community, and clinical experience in the field of cancer will be greatly augmented. At the conference, follow-up cases with good and bad results should be shown and the pathologist should present interesting operative and autopsy specimens of cancer material.

Records. Records of cancer patients coming to these clinics should be sent to the American College of Surgeons upon forms provided by the College. Subsequent follow-up records should be obtained for the College by sending, periodically to these clinics, a request for further information. Histories should be submitted of cases treated by

surgery and cauterization, as well as by X-ray and radium.

Bulletins. In return for these records, the College should send out at regular intervals, to all these organized cancer units, bulletins of information on various subjects in the cancer field, much of which has been obtained from an analysis of the record cards of cancer patients. In this way a proper give and take between the cancer group and the American College of Surgeons will be provided.

Out-patient cancer clinics. Although it is impossible for many of the group to organize a bona fide out-patient cancer clinic at present, this should be one of the ultimate objectives. Increasing numbers of interesting and early cases will present themselves and the activity of the groups will be very much extended. Eventually such out-patient clinics should hold daily sessions.

Hospitalization. As a complete institute is formed, hospitalization must be provided for cancer patients under the control of those doing the work in the institute. If the institute is a part of a general hospital, the cancer patients should be segregated wherever possible.

Cancer research. No cancer institute can be well rounded unless clinical and laboratory research are important features. Adequate, well equipped laboratories, with a trained personnel, are essential. If the men lack interest in the research side of the cancer problem, the most important part of their activity falls to the ground. These institutes and clinics should be encouraged by the American College of Surgeons to pursue research studies upon cancer.

Department of physics. A cancer institute is incomplete without an organized department of physics, controlled by a trained physicist with facilities for investigative work.

Association of cancer institutes and clinics. The College should organize such an association with an annual round table conference held at the American College of Surgeons, or in some other city, for discussion of the clinical and research problems of cancer.

REPORT OF ROBERT JOLLY, SUPERINTENDENT, BAPTIST HOSPITAL, HOUSTON, TEXAS

It was recently my pleasure and profit, as a hospital superintendent, to make the American College of Surgeons tour of sectional meetings from Phoenix, Arizona, to Lincoln, Nebraska.

It was not the first tour of its sort I have made and, therefore, I cannot be accused of being unduly excited and thrilled by what I saw, heard, and experienced. Without any exaggeration it is my opinion that these tours, planned and financed by the American College of Surgeons, are doing more for the trustees, superintendents, and personnel of the hospitals, and, therefore, for the hospitals touched by the tours, than is any other agency in America. Only a small percentage of the 7,000 hospital superintendents will ever be able to attend any of the national conventions for hospital workers. This is true because of financial difficulties. To me it is providential that these groups of noted surgeons and hospital experts are sent over the country in these sectional meetings, bringing these wonderful opportunities within a reachable distance of those who ought to attend.

In one place a surgeon said to me, "I am tired of going to these meetings, rehashing many of the things we have heard before with some few new things added." I said that I had observed that each time one of these meetings was held, more and more people attended who had never attended before and these were becoming imbued with the Standardization doctrine and were passing it on to others. In fact in a number of places I asked for a lifting of hands to see how many were attending a meeting of that sort for the first time and it was astonishing to see the large number.

Of course, I am writing from, and of, the hospital standpoint. I did not attend but one or two of the scientific meetings, but I talked with large numbers of the Fellows, and the feeling everywhere was that Dr. Crowell with his scientific meetings, bringing Drs. Scudder, Lee, Kreuscher, Adson, Mayo, and others across the continent, was making a distinct contribution toward the improvement of surgery in all its branches.

At Phoenix we found the profession very much agitated by the course being pursued by the irregulars and definite efforts being made to get the legislature to pass a bill which would protect the public from their machinations. At the public meeting, Dr. Franklin H. Martin very frankly told of his efforts with the governor and legislature in behalf of the bill and urged the public to insist that their representatives take a proper stand.

I had the pleasure, with Dr. Lee, of speaking at the Hiram Noonday Club and found this group of leading business men very much interested in the things we were advocating and was delighted to see many of them at the public meeting. This meeting was held in the Presbyterian church, which was filled to overflowing and the sympathetic and the responsive audience inspired us all.

The hospital conferences were well attended and there was not a dry moment. The lack of

formality in these round table discussions makes iteasy for all to present their problems and give their own views. At Phoenix, as well as at the conferences in the other cities, the Catholic Sisters were interested and interesting participants and added much to the value of the meetings.

At Los Angeles every meeting, scientific, hospital, and public, was largely attended and I have never seen more enthusiasm exhibited. If I were to compare the results from the different cities we visited, Los Angeles would be at the top. Dr. Scudder, Dr. Lee and Father Moulinier were enthusiastically received and Dr. Martin was acclaimed not only as president of the American College of Surgeons but as its director general and the guiding genius of its inception and its progress.

One of the most enjoyable features of the stay in Los Angeles was the dinner given by the Medical Society.

The public meeting was in the Gold Room of the Biltmore hotel. Every seat was taken and many stood. Over 3,000 were in attendance. I was especially struck by the appearance of the audience. It was not only a most intelligent looking group but an especially well dressed one.

Many of those in the audience knew of the conflict raging between the irregulars and the medical profession and Dr. Martin in no uncertain terms announced the attitude of the College and the policy to be pursued in regard to hospitals which countenance the irregular. His statement was greeted by great applause much to the surprise of many. This meeting was an index to the feeling of the people.

Vancouver was ready and waiting for us and all the meetings went off with a bang. The scientific meetings were largely attended and on every hand I heard the most favorable expressions concerning the clinics and lectures.

It was a real homecoming for Dr. MacEachern for it was here that he spent eight years as superintendent of the Vancouver General Hospital. Everywhere we went he was given an ovation and it was a joy to see how highly he was regarded not only by the profession, but by citizens in every walk of life. I think everyone in Vancouver must know him. He not only put the Vancouver General on a pinnacle as a hospital, but he made a place among the citizenry that no one can displace.

It was my privilege to speak at the Rotary and Kiwanis clubs and I found the members alert as to the hospital situation and eager to hear more about public health. Let me say here that wherever we mentioned the annual physical examination it was received with lively interest and at the close of the meetings we were bombarded with questions as to the "how."

The public meeting was a revelation of the interest of the public as to health matters. Not only was every available seating space occupied in the hall, but hundreds stood and other hundreds were compelled to go away for lack of space.

Our program lasted two hours and I did not see a single one of the hundreds who stood attempt to go out. This meeting together with all the other public meetings made me wish that the College would put on a year's campaign of public meetings in the centers of population. What a wonderful amount of good could be accomplished with one hundred public meetings in 1930.

We had a wonderful hospital conference at St. Paul's hospital and then again at the Vancouver General. The Sisters at the one and Dr. Bell at the other held back nothing that would contribute to the success of the meetings. They brought the nurses in uniform to the public meeting which added much not only to the interest but to the appearance there.

At Regina the meeting gathered momentum and the climax came at the public meeting when many stood and others were turned away.

Our hospital conferences were held in the General Hospital and the Gray Nun's where everything was done for our comfort and profit and the round tables sparkled with snappy questions and answers. A parting dinner was given the party by the Fellows of the College at which the good fellowship was continued.

Dr. MacEachern and I stopped at Brandon for one day where we inspected the General Hospital under the direction of Miss McLeod. The medical staff and board of directors were our hosts at dinner in the hospital and Dr. MacEachern met with the executive committee in closed session after the dinner.

Next day I arrived in Winnipeg where we had a public meeting at night in the Central Presbyterian church. Another packed house greeted us and gave us an enthusiastic hearing. I visited all of the hospitals of the city and was greatly impressed not only with their buildings and equipment but with the high class of work being done in them.

In Minneapolis I visited St. Mary's, Asbury, St. Barnabas, Norwegian, General, and University hospitals. I found all of them with building programs and every one committed to the Standardization program. The first day's conferences were held as usual in the hotel, and the second day the conference was held in the morning

in the General Hospital and in the afternoon in St. Mary's. At the places we visited the conferences in the hospitals assumed an even more personal touch than in the hotel, for in the hospitals we had members of the personnel in uniform each to take a place on the platform where everyone was free to cross-examine the witness and then debate the pro and con of any subject pertaining to that particular line of service. The meetings were more like the gathering of a big family or clan for stimulation of thought and exchange of ideas for the benefit of said group.

Because of the location of the State University in that city all scientific subjects and discussions took on added interest and values and the scientific men in our party were kept on the jump both physically and mentally to meet the demand upon them.

The public meeting at the Strand Theater was largely attended and the public and the newspapers were exceedingly kind in their expression of appreciation.

Our last meeting at Lincoln from the scientific and hospital standpoint was above the average, but because of the counter attractions the attendance at the public meeting was the smallest of the series.

I was particularly struck with the well balanced programs prepared for the public meetings. No one could get tired for it was arranged that each alternate fifteen minute address should be illustrated, and it is a well known fact that people do not tire when they are interested or when they see pictures. I made it a point to get in the doorway at the close of the meetings to hear the comments of those passing out. Invariably the comments were flattering and would be very encouraging to the Regents of the College could they have heard a small part of what I heard.

I shall never forget the first sectional meeting of the American College of Surgeons I attended directly after I became a hospital superintendent. I was "green," but grasping for knowledge. I had no idea what the meeting was for nor what I might learn by attending. But when two days had passed all too quickly and I had time to catch my breath after hearing so many valuable things about my job that I had never dreamed of, I found I had caught a vision and an inspiration to have not an ordinary hospital, but an extraordinary one where the patient would be protected and provided with the best. That vision and inspiration have grown since then and as I have sat in meetings on this recent tour and have seen how the hospital folk have eagerly drunk in every word and asked for more and yet more and have complained because the meetings were too short, my sympathy has gone out to them for I have traveled that same road and am yet traveling it.

I do not believe anyone but a hospital superintendent can realize what this program is meaning to our hospital fraternity and in behalf of the fraternity everywhere I urge the Regents of the College not only to keep up the program, but to enlarge it and intensify it.

Since returning home I have answered over fifty requests for information and help from those who sat in our meetings. Surely this is indicative of the interest. I am glad to have had a humble part in arousing it.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

FRANKLIN H. MARTIN, Chicago, *President* MERRITTE W. IRELAND, Washington, *President-Elect*

CHICAGO EXECUTIVE COMMITTEE

HERMAN L. KRETSCHMER, *Chairman* LOYAL DAVIS, *Secretary*

JOSEPH C. BECK	HARRY S. GRADLE	PHILIP H. KREUSCHER
ARTHUR H. CURTIS	CARL A. HEDBLOM	EDWIN MCGINNIS
VERNON C. DAVID	ALLEN B. KANAVEL	DALLAS B. PHEMISTER
CARL B. DAVIS		ALFRED A. STRAUSS

PRELIMINARY PROGRAM FOR THE CHICAGO CLINICAL CONGRESS

CHICAGO surgeons and the administrative heads of Chicago's medical institutions are keenly interested to provide a complete showing of the clinical surgical activities of this great medical center during the nineteenth annual Clinical Congress of the American College of Surgeons, which opens on Monday, October 14, continuing for five days up to and including Friday, October 18. A preliminary program of the clinics and demonstrations to be given during the Congress will be found in the following pages. The program as here published is merely an outline of what the clinicians of Chicago expect to present at this year's session, as the several hospital schedules are to be revised and amplified during the weeks preceding the Congress in order that the details of the clinical work to be demonstrated may be presented more completely. It will be noted that the program provides for operative clinics and demonstrations beginning at 2 o'clock on Monday, October 14, and for each morning and afternoon of the following four days. The real program will be issued daily during the Congress: (1) in the form of bulletins to be posted on bulletin boards at headquarters each afternoon thereby presenting an accurate and detailed schedule of the clinics and demonstrations to be given at each of the hospitals the following day, and (2) in the form of printed bulletins to be distributed each morning.

In recent years Chicago's clinical facilities have been largely increased in keeping with the growth of the city. Since 1923, when the last session of the Clinical Congress was held in Chicago, a number of new hospitals have been built and some of the older institutions have been remodeled and enlarged. With increased clinical facilities in the hospitals and a notable increase in hotel facilities, it will be possible to accommodate comfortably a much larger number of visiting surgeons at this year's meeting than at any previous session in Chicago. The Committee on Arrangements and Chicago's surgeons as a group are actively interested in maintaining Chicago's popularity as a clinical center. At the offices of the College an unusually large number of advance registrations has been received indicating a wide interest in the plans for this year's meeting.

At this year's Congress special attention is to be devoted to the demonstration of modern methods in the treatment of fractures. A series of special fracture clinics is being planned to be given daily at the Cook County Hospital by members of the surgical staff of that institution. Similar clinics are being arranged at many other of the larger hospitals. In addition to the fracture clinics given by Chicago surgeons, a special series of clinics and demonstrations is being arranged under the supervision of the College Committee on Fractures to be given at the Cook County Hospital on Tuesday and Wednesday afternoons. At these particular clinics several of the members of this committee living outside of Chicago have been asked to participate and will give demonstrations of special methods used in the more difficult fracture cases.

A series of dry clinics to be given by outstanding American surgeons at the Stevens Hotel on Tuesday and Wednesday afternoons forms an important feature of the clinical program. Among

those who will give clinics are the following: George W. Crile, Cleveland; John B. Deaver, Philadelphia; J. M. T. Finney, Baltimore; Charles H. Mayo, and F. W. Rankin, Rochester, Minn.

The ophthalmologists and otolaryngologists of Chicago are planning a highly attractive clinical program of broad scope that will include operative clinics and demonstrations covering all phases of surgical work in these specialties. In addition to the clinical program, the officers of the Chicago Ophthalmological and Chicago Laryngological societies have planned for a joint session with dinner on Wednesday evening at the Stevens Hotel. Among the speakers at that session will be Mr. Herbert Tilley, of London, one of the outstanding otolaryngologists of Great Britain. A complete program for this session will appear in a later issue.

Leaders in industry, education and labor, together with representatives of indemnity companies, surgeons and hospital administrators have been asked to attend and contribute to a conference on traumatic surgery planned for Friday morning and afternoon. At this conference the Chairman of the Committee on Traumatic Surgery will report on the work of the committee in recent years and outline future activities in this highly important part of the work of the College. The program includes an open forum for the discussion of various phases of the subject and presentation of formal papers by outstanding men. A detailed program is in course of preparation and will be published at an early date.

General headquarters for the Congress will be established at the Stevens Hotel, located on Michigan Avenue between Seventh and Eighth Streets, where the grand ballroom, three smaller ballrooms, and many other large rooms have been reserved for the exclusive use of the Congress for the scientific meetings, hospital conferences, registration and ticket bureaus, bulletin boards, scientific exhibits, executive offices, technical exhibition, etc. All of the evening meetings are to be held in the grand ballroom, the same room being used for the hospital conference on Monday, the annual meeting on Thursday afternoon, and the conference on traumatic surgery on Friday.

EVENING MEETINGS

The Executive Committee of the Clinical Congress is preparing programs for a series of five evening meetings, a preliminary outline of which will be found in the following pages. At the Presidential Meeting on Monday evening, to be held in the grand ballroom of the Stevens Hotel, the president-elect, Major General Merritte W. Ireland, surgeon-general of the United States Army, is to be inaugurated and will deliver the annual address. The Murphy oration in surgery will be delivered on the same evening by Professor D. P. D. Wilkie, professor of surgery in the University of Edinburgh. Scientific meetings will be held in the same room on Tuesday, Wednesday and Thursday evenings, and on Friday evening the annual Convocation of the American College of Surgeons. Dr. Glenn Frank, president of the University of Wisconsin, will deliver the Fellowship address at the Convocation.

ANNUAL MEETING—CANCER SYMPOSIUM

The annual meeting of the Fellows of the College will be held at 2 o'clock Thursday afternoon in the grand ballroom, at which time the reports of officers and committees will be presented and officers elected for the ensuing year. Immediately following the annual meeting there will be presented a symposium on the treatment of malignant diseases with radium and X-ray, which will include contributions by distinguished surgeons and research workers dealing with many aspects of this problem.

HOSPITAL CONFERENCE

For the annual hospital conference, which opens at 9:30 on Monday morning in the grand ballroom of the Stevens Hotel, an interesting program of broad scope has been prepared. Papers, discussions, round table conferences and demonstrations that have to do with the every-day problems of the boards of trustees, medical staffs and hospital executives will occupy the hours of both morning and afternoon of the four days, Monday to Thursday inclusive. Friday will be devoted to the inspection of Chicago hospitals. The keynote of this year's conference is "better care of the patient" and the promotion of closer relations among the several groups that have to do with the care of the patient.

At the opening session on Monday forenoon, the address of welcome will be given by Dr. Arnold H. Kegel, commissioner of health for Chicago. Distinguished guests and representatives of national organizations will be introduced by the president, Surgeon-General Merritte W. Ireland. At this session the official report on the progress of hospital standardization with the list of approved hospitals for 1929 will be presented by the director-general, Dr. Franklin H. Martin.

Among the important features of the program for the conference will be the practical demonstration of a model staff conference conducted by one of the local hospitals, in connection with

which there will be a general discussion of the entire subject of staff conferences. Other important features of the program for the conference include: A symposium on the control and elimination of infections in hospitals; an open forum on administrative problems relating to the care of the patient; an address on the health inventorium in standardized hospitals by Dr. Franklin H. Martin; a joint session with the Association of Record Librarians on Wednesday morning at which the papers and discussions will deal with increasing the efficiency of case records. Dr. M. T. MacEachern, associate director of the College in charge of hospital activities, will discuss hospital problems of the present and future.

The hospital conference is planned to interest not only surgeons but hospital trustees, executives and personnel generally, and an invitation is extended to all persons who are interested in hospital activities to attend this year's Congress. Those who will attend are invited to avail themselves of other activities of the Congress, especially to attend the Presidential Meeting Monday evening and the Convocation Friday evening.

REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares on account of the Chicago session of the Clinical Congress so that the total fare for the round trip will be one and one-half the ordinary first-class one-way fare. To take advantage of the reduced rates it is necessary to pay the full one-way fare to Chicago, procuring from the ticket agent when purchasing ticket, a "convention certificate" which certificate is to be deposited at headquarters for the visé of a special agent of the railways. Upon presentation of a viséd certificate to the ticket agent in Chicago not later than October 30th a ticket for the return journey by the same route as traveled to Chicago may be purchased at one-half the one-way fare.

In the eastern, central, and southern states and eastern provinces of Canada, tickets may be purchased between October 10th and 18th; in southwestern and western states between October 9th and 17th, and in the far western states and western provinces of Canada between October 6th and 14th. The return journey from Chicago must be begun not later than October 30th.

The reduction in fares does not apply to Pullman fares, nor to excess fares charged for passage on certain trains. Local railroad ticket agents will supply detailed information with regard to dates of sale, rates, routes, etc. Stop-overs on both the going and return journeys may be had within certain limits.

Full fare must be paid from starting point to Chicago, and it is essential that a "convention certificate" be obtained from the agent from whom the ticket is purchased. These certificates are to be signed by the general manager of the Clinical Congress and viséd by a special railroad agent in Chicago during the meeting. No reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route as that used to Chicago and that the certificate must be deposited at headquarters during the meeting and return ticket purchased and used not later than October 30th.

It will be noted that the arrangement outlined above, extending the return limit to October 30th, allows for an additional twelve days following the close of the Clinical Congress thus providing an opportunity for visiting other clinical centers in the middle west.

An exception to the above arrangement is to be noted in the case of persons traveling from points in certain far western states and British Columbia, who will be able to purchase round trip summer excursion tickets which will be on sale up to and including September 30th with a final return limit of October 31st. The summer excursion fare is somewhat lower than the convention fare mentioned above, but is available only in certain of the far western states and British Columbia. Tickets sold at summer excursion rates permit traveling to Chicago via direct route and returning via another direct route, with liberal stop-over privileges.

LIMITED ATTENDANCE

Attendance at the Chicago session will be limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories in the hospitals and medical schools to determine their capacity for accommodating visitors. Under this plan it will be necessary for those who wish to attend to register in advance.

Attendance at all clinics and demonstrations will be controlled by means of special clinic tickets, which plan provides an efficient means for the distribution of the visiting surgeons among the several clinics, and insures against overcrowding, as the number of tickets issued for any clinic will be limited to the capacity of the room in which that clinic will be given. Clinic tickets will be distributed each morning and may be reserved late on the previous day.

REGISTRATION FEE

A registration fee of $5.00 is required of each surgeon attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card at headquarters. This card, which is non-transferable, must be presented to secure clinic tickets and admission to the evening meetings.

CHICAGO HOTELS AND THEIR RATES

In recent years a number of fine large hotels have been built in Chicago, among which is the Stevens with its 3000 guest rooms. Ample first-class hotel facilities are available, many of the hotels being located within short walking distance of the headquarters hotel.

	Minimum Rates with Bath	
	Single Room	Double Room
Auditorium, Michigan Ave. and Congress St.	$3.50	$5.00
Belmont, 3100 Sheridan Road	4.00	5.00
Bismarck, 175 W. Randolph St	3.50	5.00
Blackstone, Michigan Ave. and East 7th St.	5.00	10.00
Chicago Beach, Hyde Park Blvd. at the Lake	5.00	5.00
Congress, Michigan Ave. and Congress St.	4.00	6.00
Drake, Michigan Ave. and Walton Place	5.00	6.00
Edgewater Beach, 5349 Sheridan Road	4.00	6.00
Fort Dearborn, Van Buren and LaSalle Sts.	1.95	3.00
Great Northern, Jackson Blvd. and Dearborn	3.50	4.50
Knickerbocker, Walton Place and Michigan	3.00	5.00
Lake Shore Drive, 181 Lake Shore Drive	5.00	7.00
LaSalle, LaSalle and Madison Sts	3.00	4.50
Morrison, Clark and Madison Sts	2.50	5.00
Palmer, Monroe and State Sts	4.00	7.00
Parkway, 211 Lincoln Park West	3.00	5.00
Pearson, St. Clair and Pearson Sts	3.50	5.00
Sherman, Clark and Randolph Sts	3.00	4.00
Stevens, Michigan Ave. and 7th St	3.50	6.00
Webster, Lincoln Park West at Webster Ave.	3.00	5.00

CLINICAL DEMONSTRATIONS

Tuesday, 2 P.M.—Grand Ballroom, Stevens Hotel

J. M. T. FINNEY, M.D., Baltimore: Surgery of the stomach.

BURTON J. LEE, M.D., New York: Tumors of the breast.

CHARLES H. MAYO, M.D., Rochester: The general problems of cancer.

F. W. RANKIN, M.D., and C. W. MAYO, M.D., Rochester: Cancer of the small intestine.

Wednesday, 2 P.M.—Grand Ballroom, Stevens Hotel

GEORGE W. CRILE, M.D., Cleveland: Influence of the thyroid and of the adrenals in the production and treatment of peptic ulcer.

WALTER E. DANDY, M.D., Baltimore: Brain surgery.

JOHN B. DEAVER, M.D., Philadelphia: Abdominal surgery.

PRELIMINARY PROGRAM FOR EVENING MEETINGS

Presidential Meeting—Monday, 8:15 P.M.—Grand Ballroom, Stevens Hotel

Address of Welcome: HERMAN L. KRETSCHMER, M.D., Chicago, Chairman of Committee on Arrangements.

Address of Retiring President: FRANKLIN H. MARTIN, M.D., Chicago.

Introduction of Foreign Guests.

Inaugural Address: Surgery in the Medical Department of the United States Army. MAJOR GENERAL MERRITTE W. IRELAND, Washington.

The John B. Murphy Oration in Surgery: Some Principles in Abdominal Surgery. PROFESSOR D. P. D. WILKIE, Edinburgh, Scotland.

Tuesday, 8:15 P.M.—Grand Ballroom, Stevens Hotel

FRANK H. LAHEY, M.D., Boston: Hyperthyroidism Associated with Cardiac Disorders.
Discussion: H. M. RICHTER, M.D., and OSCAR NADEAU, M.D., Chicago.

EDWARD W. ARCHIBALD, M.D., Montreal: Some Phases of Thoracic Surgery.
Discussion: CARL A. HEDBLOM, M.D., and RALPH B. BETTMAN, M.D., Chicago.

WALTMAN WALTERS, M.D., Rochester, Minn.: A Method of Reducing the Incidence of Fatal Postoperative Pulmonary Embolism.
Discussion: EDWIN M. MILLER, M.D., Chicago.

Wednesday, 8:15 P.M.—Grand Ballroom, Stevens Hotel

JAMES HEYMAN, M.D., Stockholm, Sweden: Radiology as a Complete or Partial Substitute for Surgery in the Treatment of Cancer of the Female Pelvic Organs.
Discussion: ARTHUR H. CURTIS, M.D., and HENRY SCHMITZ, M.D., Chicago.

WILLIAM B. HOLDEN, M.D., Portland, Oregon: The Surgical Treatment of Intestinal Obstruction.
Discussion: FREDERIC A. BESLEY, M.D., JOHN A. WOLFER, M.D., and LESTER R. DRAGSTEDT, M.D., Chicago.

CHARLES L. SCUDDER, M.D., Boston: Oration on Fractures.

Thursday, 8:15 P.M.—Grand Ballroom, Stevens Hotel

A. W. ADSON, M.D., Rochester, Minn.: Surgical Indications for Sympathetic Ganglionectomy and Trunk Resection in the Treatment of Chronic Arthritis. (In collaboration with LEONARD G. ROWNTREE, M.D.)
Discussion: LOYAL DAVIS, M.D., and LEWIS J. POLLOCK, M.D., Chicago.

Symposium: Pernicious Anæmia.

GEORGE H. WHIPPLE, M.D., Rochester, N. Y.: Physiological Background of the Treatment of Pernicious Anæmia by Diet Factors.

C. C. STURGIS, M.D., Ann Arbor, Mich.: The Treatment of Pernicious Anæmia by Liver Feeding.

WILLIAM P. MURPHY, M.D., Boston: Newer Developments of Liver Feeding in Cases of Anæmia; Liver Feeding in Diseases of the Liver.

Discussion: CHARLES A. ELLIOTT, M.D., Chicago.

Convocation—Friday, 8:15 P.M.—Grand Ballroom, Stevens Hotel

Conferring of Honorary Fellowships.

Presentation of Candidates for Fellowship, Class of 1929.

Presidential Address: The Medical Department of the United States Army. MAJOR GENERAL MERRITTE W. IRELAND, Washington.

Fellowship Address: DR. GLENN FRANK, President of the University of Wisconsin, Madison.

PRELIMINARY CLINICAL PROGRAM

GENERAL SURGERY, GYNECOLOGY, OBSTETRICS, UROLOGY, ORTHOPEDICS

WESLEY MEMORIAL HOSPITAL

Monday

M. T. GOLDSTINE—2. Hysterectomy, vaginal plastics.

Tuesday

G. DE TAKATS—9. Varicose veins, spinal anæsthesia; thyroidectomy, local anæsthesia.
GUY S. VAN ALSTYNE—9. General surgery.
LOYAL DAVIS—2. Brain surgery.

Wednesday

R. W. MCNEALY—9. Hernias and blood vessel surgery.
ALLEN B. KANAVEL—9. General surgery.
JOHN A. WOLFER—9. Duodenal stasis and periduodenitis.
P. B. MAGNUSON and WILLIAM A. HENDRICKS—2. Plastic on hip; spinal fusion.

Thursday

EUGENE B. PERRY—9. Cystoplasties and kidney surgery.
O. S. PAVLIK—10. Hysterectomy and ovarian transplantation.
ALLEN B. KANAVEL—9. General surgery.
V. D. LESPINASSE—2. Genito-urinary surgery.
C. J. DEBERE—4. Rectal surgery.

Friday

R. W. MCNEALY—9. General surgery.
MICHAEL MASON—10. Dupuytren's contraction.
J. J. GILL—10. Obstetrical surgery; pathological obstetrics.
M. C. ERLICK—2. Hysterectomy, ovarian cysts.
P. B. MAGNUSON and WILLIAM A. HENDRICKS—2. Plastic on hip; spinal fusion.

RAVENSWOOD HOSPITAL

Monday

G. W. GREEN—2. Gallstone clinic.
G. N. BUSSEY—2. Abdominal hysterectomy, fibroids.
G. DE TARNOWSKY—2. Hæmorrhagic colitis.

Tuesday

C. A. BUSWELL—9. Carcinoma of the cervix uteri.
D. B. POND—9. Fracture clinic.
R. E. DYER—9. Fallopian tube visualization with lipiodol.
W. F. GROSVENOR, C. C. RENTFRO, and F. W. ROHR—2. Obstetrical conference.

Wednesday

E. B. WILLIAMS—9. Abdominal hysterectomy, fibroids.
P. J. SARMA—9. Abdominal wall incisions based on physiologic grounds.
F. VON NAHOWSKI—9. Hepatic abscess.

Thursday

L. WILDER—9. Goiter cases.
E. W. MUELLER—9. Treatment of burns.
W. F. GROSVENOR, C. C. RENTFRO, and F. W. ROHR—2. Obstetrical conference.
G. DE TARNOWSKY—9. Ruptures of urinary bladder.

Friday

G. W. GREEN—9. Surgical clinic.
A. G. SCHROEDER—9. Surgical clinic.

COOK COUNTY HOSPITAL

Monday

F. H. FALLS—2. Operative obstetrics.
SUMNER L. KOCH—2. Surgery of the hand; general surgery.

Tuesday

R. W. MCNEALY—9. Blood vessel surgery.
A. E. KANTER—9. Operative gynecology.
W. R. CUBBINS—9. Ward walk in fracture ward.
E. L. CORNELL—9. Complications of pregnancy and labor
H. JACKSON—10. Injuries of the brain.
J. R. HARGER—10. Acute osteomyelitis.
E. M. MILLER—10. Toxic thyroid disease in children; purpura hæmorrhagica.
D. C. STRAUSS—11. Surgery of the thyroid.
KELLOGG SPEED—2. Tumors of bone; fractures of carpal bones.
GEORGE DE TARNOWSKY—2. Rupture of the bladder.
E. J. LEWIS—2. Sliding hernia.
J. P. GREENHILL—2. Operative gynecology.

Wednesday

HARRY CULVER—9. Genito-urinary surgery.
W. R. CUBBINS—9. Round table discussion on fractures.
H. SCHMITZ—9. Inflammation of the pelvic organs; carcinoma of the pelvic organs.
F. J. JIRKA—10. General surgery.
P. H. KREUSCHER—10. Osteomyelitis; congenital deformities; arthroplasty of hip; arthroplasty of elbow.
J. R. BUCHBINDER—2. Surgery of the thyroid.
F. H. FALLS—2. Operative obstetrics.
J. P. FITZGERALD—2. Obstetrical complications.
H. C. ROLNICK—2. Intravenous anæsthesia in urologic surgery.
SUMNER L. KOCH—2. Surgery of the hand; general surgery.

Thursday

R. W. MCNEALY—9. Blood vessel surgery.
J. R. HARGER—10. Acute osteomyelitis.
E. M. MILLER—10. Fractures about the elbow in children.
H. JACKSON—10. Operations under spinal anæsthesia.
KARL MEYER—10. Gastric surgery.
W. R. CUBBINS—2. Fractures of femur.
D. S. HILLIS—2. Obstetrics.
A. F. LASH—2. Treatment of puerperal infection.

Friday

G. L. APFELBACH—9. Surgical complication of diabetes.
A. E. KANTER—9. Operative gynecology.
E. L. CORNELL—9. Complications of pregnancy and labor.
F. A. DYAS—10. Thyroid disease; carcinoma of the breast.
V. C. DAVID—10. Carcinoma of large bowel.
GEORGE DE TARNOWSKY—2. General surgery.

ALEXIAN BROTHERS' HOSPITAL

E. W. WHITE, EDWARD HESS, A. WOCHINSKI, C. O. ROTCH, ALF HOLM, and J. GLASSER—9, daily. Genito-urinary clinic.
M. L. HARRIS, AUGUST ZIMMERMAN, and DANIEL MURPHY—9, daily. General surgical clinic.
RALPH WHEELER, WILLIAM SWIFT, FRANK BAYLOR, and K. I. STEVENS—9, daily. Fracture clinic.

MERCY HOSPITAL

Monday

R. S. BERGHOFF—2. Differential diagnosis of chest diseases.
JOSEPH LAIBE—2. Urologic surgery; the relation of urology to gynecology.
P. H. KREUSCHER—2. Congenital dislocations of the hip; injection treatment of varicose veins.

Tuesday

L. D. MOOREHEAD—9. Surgery of the thyroid gland: Exophthalmic goiter, toxic adenoma, parenchymatous goiter, and mixed type of goiter.
J. F. GOLDEN—9. Abdominal surgery.
F. C. JACOBSEN—9. Fractures in industrial surgery.
J. B. O'DONOUGHUE—2. Tumors of breast, their surgical significance; clinical significance of reverse peristalsis of the upper intestinal tract, particularly in reference to gastrojejunal anastomosis; reaction of different classes of thyroid cases to surgery, and treatment of some unusual complications.
C. L. MARTIN—2. Polyps of the rectum and sigmoid; tuberculous ulcers of the sigmoid and rectum.

Wednesday

C. F. SAWYER—9. Pancreatitis—acute, subacute, and chronic; types of intestinal obstruction.
M. F. MCGUIRE—9. Treatment of diseases of the gall bladder and bile ducts; carcinoma of the colon.
J. E. KELLEY—9. The acute abdomen.
HENRY SCHMITZ—2. Early diagnosis and treatment of uterine and mammary cancers. Diagnosis and treatment of sterility due to blocked uterine tubes.
M. C. MULLEN—2. Toxemias of pregnancy.

Thursday

P. H. KREUSCHER—9. Treatment of advanced scoliosis; fractures involving the knee joint; fractures of the hip.
F. E. PIERCE—9. Fracture clinic.
F. M. DRENNAN, L. E. GARRISON, and C. F. SAWYER—2. Joint discussion on duodenal pathology with presentation of cases and the results of some experimental work; consideration of œsophageal stenosis by Dr. Drennan.
M. MANDEL—2. Pernicious anemia.

Friday

HENRY SCHMITZ—9. Gynecological surgery.
GEORGE GRIFFIN—9. Gastro-intestinal surgery.
J. D. CLARIDGE—9. Dislocation of internal semilunar cartilage.
W. S. BARNES—2. Gynecological clinic.
W. J. PICKETT—2. Fascial suture in the repair of hernia.
A. V. PARTIPILO—2. Closed aseptic gastro-intestinal anastomosis.
B. B. BEESON—2. Dermatological conditions which may become surgical.

UNITED STATES VETERANS HOSPITAL
(Edward Hines Jr. Hospital, Hines, Ill.)

Thursday

CARL A. HEDBLOM—9. Operations: Thoracoplasty (two cases); phrenicoexeresis.
PHILIP H. KREUSCHER—1:30. Operation for chronic osteomyelitis.
ROBERT O. RITTER—2:30. Spinal fusion.
JOHN S. COULTER—3:30. Demonstration in physical therapy.

PRESBYTERIAN HOSPITAL

Tuesday

A. D. BEVAN and associates—9. General surgical operations.
A. D. BEVAN, DR. GATEWOOD, and R. C. BROWN—9. Gall-bladder surgery.
HERMAN L. KRETSCHMER—9. Urological surgery.
R. H. HERBST—9. Urological surgery.
V. C. DAVID—9. General surgical operations.
CARL DAVIS—9. General surgical operations.
N. SPROAT HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN, and C. P. BAUER—9. Gynecological and obstetrical clinics.
W. C. THOMAS—10:30. Blood chemistry and postoperative care.
A. D. BEVAN, DR. DAVIS, and V. C. DAVID—Surgery of the large bowel.
A. H. MONTGOMERY—12. Intussusception.

Wednesday

A. D. BEVAN and associates—9. General surgical operations.
HERMAN L. KRETSCHMER—9. Urological surgery.
N. SPROAT HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN, and C. P. BAUER—9. Gynecological and obstetrical clinics.
WILBUR POST—10:30. Medical preparation of poor surgical risks for surgery.
KELLOGG SPEED—11. General surgical operations; knee joint cases.
E. MILLER—9. General surgical operations.
A. D. BEVAN, DR. DAVIS, E. M. MILLER, and DR. LORING—11. Surgery of the thyroid.
ISABELLE HERBST—11:40. Anæsthesia in goiter surgery.

Thursday

A. D. BEVAN and associates—9. General surgical operations.
HERMAN L. KRETSCHMER—9. Urological surgery.
R. H. HERBST—9. Urological surgery.
V. C. DAVID—9. General surgical operations.
KELLOGG SPEED—9. Bone surgery.
E. M. MILLER—9. Posterior dislocation of the shoulder.
A. H. PARMELEE—9. Diagnosis of acute osteomyelitis.
V. C. DAVID—9. Regeneration of bone in osteomyelitis.
R. C. WOODYATT—9. Preparation of diabetics for surgery.
GEORGE F. DICK—9. Erysipelas.
PETER BASSOE and W. J. POTTS—9. Charcot joints.
A. H. MONTGOMERY—9. Treatment of burns.
N. SPROAT HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN, and C. P. BAUER—9. Gynecological and obstetrical clinics.
H. A. OBERHELMAN—11. Surgical pathology.

Friday

A. D. BEVAN and associates—9. General surgical operations.
A. D. BEVAN, DR. GATEWOOD, R. C. BROWN, D. P. ABBOTT, and C. G. GRULEE—9. Surgery of the stomach.
HERMAN L. KRETSCHMER—9. Urological clinic.
CARL DAVIS—9. General surgical operations.
N. SPROAT HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN, and C. P. BAUER—9. Gynecological and obstetrical clinics.
E. E. IRONS—10:30. Relation of focal infection to surgery.
DR. GATEWOOD—11. Subphrenic abscess.
FREDERICK MOOREHEAD—11:20. Surgery of the mouth and face.

MICHAEL REESE HOSPITAL

Tuesday

ALFRED A. STRAUSS. Stomach resection for gastric and duodenal ulcer; common duct duodenal anastomosis for recurrent gall stones.
HARRY JACKSON. Bone tumors and osteomyelitis.
D. C. STRAUSS. Thyroid surgery.
IRVIN S. KOLL. Pyelotomy for stone; nephrectomy for kidney tumor; urethral plastics.
JULIUS E. LACKNER. Abdominal hysterectomy; interposition operation; rectovaginal fistula.
W. H. RUBOVITS. Obstetrical demonstration of forceps, version and complete suture, episiotomy.

Wednesday

ALFRED A. STRAUSS. Gastric resection for ulcer and a complete colectomy and blood transfusion.
GEORGE L. DAVENPORT. General surgery; surgery of the central nervous system.
RALPH B. BETTMAN. Surgery of the chest.
J. S. EISENSTAEDT. Undescended testes and prostatectomy.
CHARLES M. JACOBS and DANIEL LEVENTHAL. Orthopedic surgery.
L. E. FRANKENTHAL. Gynecological operations.

Thursday

ALFRED A. STRAUSS. Stomach resection for gastric and duodenal ulcer and carcinoma of the colon.
GEORGE L. DAVENPORT. General surgery.
D. C. STRAUSS. Gall-bladder surgery.
JOSEPH L. BAER. Complete perineal laceration, ovarian tumor and pelvic inflammation.
IRVING STEIN. Obstetrical demonstration, low cervical cæsarean under local anæsthesia.
GUSTAV KOLISCHER. Bladder tumors.
HARRY C. ROLNICK. Prostatectomy.

Friday

ALFRED A. STRAUSS. Gastric resection for carcinoma and gall-bladder surgery.
GEORGE BETTMAN. General surgery of malignant tumors.
HELIODOR SCHILLER. General surgery, treatment of extensive carbuncle.
HARRY KATZ. Diverticulum of bladder.
ALFRED E. JONES. Spinal anæsthesia and prostatectomy.
JULIUS E. LACKNER and W. H. RUBOVITS. Sturmdorf-Wertheim operation for carcinoma of the cervix, plastic repair.
JOSEPH L. BAER and IRVING STEIN. Prolapse; vaginal hysterectomy; fibroids; occiput posterior.

CHICAGO LYING-IN HOSPITAL

Monday

JOSEPH B. DE LEE—2. Motion pictures of laparotrachelotomy.

Tuesday

D. A. HORNER and L. E. NADELHOFFER—9. Obstetrical clinic.
A. R. LAPHAM—2. Obstetrical clinic.

Wednesday

J. P. GREENHILL and M. E. DAVIS—9. Obstetrical clinic

Thursday

E. L. CORNELL and M. P. URNES—9. Obstetrical clinic

Friday

J. H. BLOOMFIELD and H. BUXBAUM—9. Obstetrical clinic.

ST. JOSEPH'S HOSPITAL

Tuesday

FRANK DAVID and C. J. DEBERE—9. Rectal surgery.
W. H. G. LOGAN—9. Oral surgery.
CHARLES M. MCKENNA—9. Genito-urinary surgery.
HUGH MCKENNA, OSCAR OFNER, DAVID FITZGERALD and GEORGE FITZGERALD—9. General surgery.
CHARLES SCHOTT—9. Results of Rammstedt operation for pyloric stenosis in infants.

Wednesday

FRANK DAVID and C. J. DEBERE—9. Rectal surgery.
F. B. MCCARTY, E. P. CARROLL and JOHN BOLAND—9. General surgery.
W. F. GROSVENOR, H. BUXBAUM, L. W. MARTIN, T. J. O'DONOGHUE, F. W. ROHR and G. COTTS—11. Gynecology.

Thursday

FRANK DAVID and C. J. DEBERE—9. Rectal surgery.
W. H. G. LOGAN—9. Oral surgery.
CHARLES M. MCKENNA—9. Genito-urinary surgery.
HUGH MCKENNA, OSCAR OFNER, DAVID FITZGERALD and GEORGE FITZGERALD—9. General surgery.
L. E. HINES—9. Demonstration of laboratory work as applied to surgery.

Friday

F. B. MCCARTY, E. P. CARROLL and JOHN BOLAND—9. General surgery.
W. F. GROSVENOR, H. BUXBAUM, L. W. MARTIN, T. J. O'DONOGHUE, F. W. ROHR and G. COTTS—11. Gynecology.

SPECIAL FRACTURE CLINICS

(At Cook County Hospital, Arranged by the Committee on the Treatment of Fractures)

Tuesday

CHARLES L. SCUDDER, Boston (Chairman of Committee)—2. The aims and work of the Fracture Committee.
M. S. HENDERSON, Rochester, Minn.—2:30. Non-union after fracture, massive bone graft, lantern slide demonstration and patients.
W. C. CAMPBELL, Memphis, Tenn.—3:30. Reduction by closed manipulation of fracture of the shaft of the femur, two cases.
P. D. WILSON, Boston—4:15. Operation: Subastragular arthrodesis for fracture of the os calcis.

Wednesday

FRED C. COTTON, Boston—2. Artificial impaction for fracture of neck of femur, two cases.
WILLIAM O'NEIL SHERMAN, Pittsburgh—2:45. Plating for fracture of shaft of femur.
E. L. ELIASON, Philadelphia—3:30. Pathologic fractures.
COLONEL W. E. KELLER, Washington—4. Old fracture dislocation at the shoulder.

ST. LUKE'S HOSPITAL

L. L. MCARTHUR, S. W. MCARTHUR, H. E. JONES, C. A. HEDBLOM, SAMUEL PLUMMER, and W. B. FISK—9, daily. General surgical clinics.
LOUIS SCHMIDT and HARRY CULVER—9, daily. Genito-urinary clinics.
E. L. RYERSON, PHILIP LEWIN, R. O. RITTER, F. A. CHANDLER, and H. B. THOMAS—9, daily. Orthopedic clinics.
ARTHUR H. CURTIS and H. O. JONES—2, daily. Gynecological clinics.

JOHN B. MURPHY HOSPITAL

Monday

HENRY R. KENNY. Surgery of bones and joints; arthrodesis of the knee.
WILLIAM GEHL. Renal function test; urological surgery.
F. H. KAMPF. Hallux valgus.

Tuesday

M. J. PURCELL. Fracture clinic.
GUSTAV BRANDLE. Operative treatment of cranial injuries.
A. C. SLINDE. Conservative surgery for hydronephrosis.
S. S. MCNEIL. Plastic operations on hand and face.

Wednesday

ARNOLD H. KEGEL. Thyroid clinic, operation and demonstration of cases.
E. V. J. YOUNG. Operative treatment of old fracture of the os calcis.
JAMES LARKIN. Radium treatment of carcinoma of cervix.

Thursday

WILLIAM GEHL. Two-stage suprapubic prostatectomy.
JOSEPH CUNNINGHAM. Management of the eclamptic patient.
JOHN WALLNER. Diagnosis and management of sterility.
J. WILSON GRIMES. Surgical treatment of pulmonary tuberculosis.
L. C. MCDERMOTT. Cæsarean section.

Friday

A. C. GARVEY. Surgical treatment of ulcers of the stomach.
J. M. HAMILTON. Surgery of the nervous system.
F. O. BOWE. Tendon grafting.
JAMES J. MCGUINN. Carcinoma of the colon and sigmoid.
J. E. LEO. Surgery of the gall bladder and common duct.

UNIVERSITY HOSPITAL

Tuesday

ADOLPH KRAFT—9. Suppuration about the diaphragm.
GEORGE M. LANDAU—10. Pathological aspects of the lung from a roentgenological standpoint.
MAX MEYEROVITZ—11. Surgical conditions of Meckel's diverticulum.

Wednesday

HARRY SINGER—9. Demonstration of gastro-intestinal specimens.
KARL A. MEYER—10. Gastro-intestinal surgery.

Thursday

ARTHUR H. CONLEY—9. Calcium and phosphorous metabolism in fractures.
CHARLES DAVISON—10. Surgery of autogenous bone transplants.

Friday

O. H. ROHRLACK—9. Surgical obstetrics.
MARSHALL DAVISON—10. Surgery of undescended testes.

RUSH MEDICAL COLLEGE

Tuesday

CARL DAVIS—11. Surgical clinic.

Wednesday

N. S. HEANEY—11. Gynecological clinic.

Thursday

A. D. BEVAN—11. Surgical clinic.

Friday

CARL DAVIS—11. Surgical clinic.

PASSAVANT MEMORIAL HOSPITAL—NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

Monday

CHARLES A. ELLIOTT and associates—2. Symposium on diseases of the liver and bile passages: Cirrhosis of the liver by Paul Starr; surgery in jaundiced patients by H. M. Richter; the gall-bladder hormone by A. C. Ivy; the spinal cord pathway of afferent impulses from the gall bladder by J. T. Hart and R. C. Crain.

Tuesday

H. M. RICHTER—9. Cholecystectomy, cholelithiasis.
LOYAL DAVIS—9. Trigeminal neuralgia.
S. W. RANSON, L. J. POLLOCK, and LOYAL DAVIS—2. Symposium on the diagnosis and surgical treatment of diseases affecting muscle function.

Wednesday

ALLEN B. KANAVEL—9. Thyroid surgery.
J. R. BUCHBINDER—9. Thyroid surgery.
JAMES G. CARR, CHARLES A. ELLIOTT, H. M. RICHTER, and ALLEN B. KANAVEL—2. Symposium on diseases of the thyroid gland.

Thursday

H. M. RICHTER—9. Thyroid surgery.
LOYAL DAVIS—9. Brain tumor.
ALLEN B. KANAVEL, SUMNER L. KOCH, MICHAEL L. MASON, and C. G. SHEARON—2. Symposium on surgery of the hand.

Friday

ALLEN B. KANAVEL—9. Dupuytren's contraction.
SUMNER L. KOCH and MICHAEL L. MASON—9. Tendon transplantation.

(Note—Morning clinics at Passavant Memorial Hospital, afternoon clinics at Northwestern University Medical School.)

COLUMBUS HOSPITAL

Monday

D. A. ORTH—2. Abdominal surgery.

Tuesday

FRED MUELLER—2. Orthopedic surgery.

Wednesday

M. J. SEIFERT and D. RUPP—9. Gastric surgery.

Thursday

DRS. WILLIAM and LENA SADLER—9. Gynecological surgery.

NORTH CHICAGO HOSPITAL
(At Grant Hospital)

Tuesday

FREDERICK HARVEY—9. Fracture clinic, with special reference to fractures about the ankle and elbow.

Wednesday

CARL BECK—9. Plastic surgery of the hands and fingers.

Thursday

FREDERICK HARVEY—9. Thyroid clinic.

Friday

CARL BECK—9. Hypospadias.

CHICAGO MEMORIAL HOSPITAL

Monday

VANCE RAWSON—2. Cardiovascular disease and surgery.
CHARLES J. DRUECK—3. Diverticulitis.

Tuesday

ARTHUR E. MAHLE—9. Management of the thyroid patient.
PETER S. CLARK—9. Surgery of the thyroid.
JULIA C. STRAWN—2. Surgical gynecology.
JAMES E. FITZGERALD and M. RUTH MCGUIRE—3:30. Surgical obstetrics.

Wednesday

BENNETT R. PARKER—9. Surgery of the gall bladder and bile tract.
J. W. PARKER—9. Hydronephrosis and hypernephroma.
FRANK WRIGHT and ALBERT ZRUNEK—10. Demonstration of humoral colloids; relation of the colloids of the plasma to surgical problems.
ROBERT A. MELENDY—2. Empyema and allied conditions.
GEORGE L. BROOKS and ROBERT A. MELENDY—4. Surgery in diabetics.

Thursday

CHARLES E. KAHLKE—9. Surgery of the stomach and duodenum.
PAUL M. CLIVER—2. Fractures, general management, operation, treatment and results.
CHARLES J. DRUECK—3. Unusual rectal fistulas.
M. L. WEINSTEIN—4. Gall-bladder surgery under local anæsthesia.

Friday

LAWRENCE L. ISEMAN—9. The cancer problem.

WASHINGTON PARK COMMUNITY HOSPITAL

Tuesday

C. C. CLARK—9. Thyroid operation; carcinoma of breast.
H. H. COX—9. Cholecystectomy; hemorrhoids.
Y. JORANSON—2. Blood transfusion; spinal anæsthesia.
F. P. HAMMOND—2. Hernia, recurrent and ventral; management of fracture about ankle.

Wednesday

S. C. HOGAN—9. Gastric resection; gall-bladder surgery.
L. B. BELL—9. Cholecystectomy; posterior gastro-enterostomy.
C. C. COX—2. Hysterectomy; carcinoma of breast; thyroid.
C. C. CLARK—2. Hernia; gastro-enterostomy.

Thursday

F. P. HAMMOND—9. Osteomyelitis; empyema.
Y. JORANSON—9. Goiter; gastro-enterostomy.
L. B. BELL—2. Appendectomy; hemorrhoidectomy.
S. C. HOGAN—2. Hysterectomy; thyroid.

ST. ANTHONY DE PADUA HOSPITAL

Tuesday

LAWRENCE RYAN, FRED EHRMANN, STEPHEN DONLON, and JOSEPH ZABORTSKY—9. General surgical operations.
OTTO J. HIRSA—9. Genito-urinary surgery.
L. S. TICHY—9. X-ray demonstration.

Thursday

JOHN SPRAFKA, FRED OLLENTINE, FRANK JIRKA, and RALPH CUPLER—9. General surgical operations.
HARRY SMIJKL—9. Genito-urinary surgery.
MAX WEISKOPF—9. Obstetrics.
L. S. TICHY—9. X-ray demonstration.

WOMEN AND CHILDREN'S HOSPITAL

Tuesday

DRS. PARSON and TRUE—9. Lipiodol visualization of the uterine and tubal cavities.
PEARL M. STETLER—9. Watkins-Wertheim operation.
CONSTANCE O'BRITIS—9. General surgical operations.
HELEN FLYNN—2. Dry clinic: Treatment of carcinoma of the uterus, breast and intestines, Flynn method.
MARY E. WILLIAMS—2. Dry clinic: Treatment of carcinoma of the cervix and uterus with radium.
MARGARITE H. AUSTIN—2. Dry clinic: Cardiograms and heart cases.

Wednesday

MARIE ORTMAYER—9. Cystoscopic demonstrations.
ANNA BLOUNT—9. General surgical operations.
RACHELLE YARROS—2. Social hygiene in relation to obstetrics and gynecology.
GIRY OTIS—2. X-ray demonstration.
JOHANNA HEUMANN—2. Pediatric cases.
CLARA OCHES—2. Twilight sleep demonstration, obstetrical cases.

Thursday

JOSEPHINE MCCOLLUM and FRANCES E. HAINES—9. Demonstration of various types of anæsthesia, methylene, nitrous oxide, chloroform and ether.
ALICE CONKLIN—9. Hernia operations.
BERTHA BUSH—9. General surgical operations.
BERTHA VAN HOOSEN—2. Dry clinic: General surgical cases.
WALBURGA L. KACIN—2. Twilight sleep demonstration, obstetrical cases.

Friday

PEARL M. STETLER—9. Thyroidectomy.
JULIA STRONG—9. Gynecological operations.
EFFIE L. LOBDELL—9. Studies in sterility with demonstration of cases.
LENA K. SADLER—9. Laparotomy.
ALICE CONKLIN—9. Hysterectomy for fibroid.

WEST SIDE HOSPITAL

Tuesday

C. R. G. FORRESTER and H. C. LYMAN—9. Fracture clinic, local anæsthesia in reduction of fractures.
E. W. BROWN—11. Surgery of gastric and duodenal ulcers.
P. C. GEORGAN—2. Abdominal surgery, management of intestinal obstruction.

Wednesday

J. S. NAGEL—9. Prostatectomies; demonstration of functional tests in renal surgery; neoplasms of the kidney.
G. F. THOMPSON—9. Surgery of the bile tracts.
S. G. WEST—11. Vaginal hysterectomy; vaginal route in pelvic surgery.

Thursday

C. R. FORRESTER and H. C. LYMAN—9. Results of air insufflation in treatment of sequela of cranial injuries; operative treatment of recent and old bone and joint injuries.
C. C. O'BYRNE—11. Goiter clinic.
A. M. HARVEY and J. H. CHIVERS—2. Industrial surgery.

Friday

A. N. CLAGGETT—9. Radium in the treatment of malignant disease, demonstration of cases.
C. G. SCHUESTZER—11. Genito-urinary surgery: Cystoscopies, renal catheterization and X-ray demonstration, treatment of hydronephrosis.

ALBERT MERRITT BILLINGS HOSPITAL

Monday

LESTER DRAGSTEDT—2. Abdominal surgery, intestinal obstruction.

Tuesday

PERCIVAL BAILEY—9. Surgery of the spinal cord.
D. B. PHEMISTER, L. DRAGSTEDT, G. M. CURTIS, and C. B. HUGGINS—9. Surgical operations.

Wednesday

D. B. PHEMISTER—9. Surgery of bones and joints.
P. BAILEY, G. M. CURTIS, L. DRAGSTEDT, and C. B. HUGGINS—9. Surgical operations.

Thursday

G. M. CURTIS—9. Surgical operations.
D. B. PHEMISTER, P. BAILEY, L. DRAGSTEDT, and C. B. HUGGINS—9. Surgical operations.

Friday

C. B. HUGGINS—9. Genito-urinary operations.
D. B. PHEMISTER, P. BAILEY, G. M. CURTIS and L. DRAGSTEDT—9. Surgical operations.

LAKE VIEW HOSPITAL

Tuesday

H. P. SAUNDERS—9. Surgery of the gall bladder, demonstration of cases.
B. C. CORBUS—2. Bladder tumors.

Wednesday

ANDRE L. STAPLER—2. Thyroidectomies, toxic adenoma, with spinal bloch. hysterectomies, fibroids, with spinal anæsthesia.

Thursday

JOHN W. BIRK—9. Obstetrical clinic, presentation of pathological cases.
WALTER S. SIEWERTH—2. Surgical correction of pathology of female genitalia.

Friday

C. I. WYNEKOOP—9. Surgery of the abdomen, demonstration of cases.

EVANGELICAL DEACONESS HOSPITAL

Tuesday

EDWARD M. HEACOCK—9. Operative treatment of uterine fibroids.

Wednesday

A. J. SCHOENBERG—9. Carcinoma of the cervix uteri.
F. O. BOWE—2. Placenta prævia and management of its complications.

Thursday

C. V. BACHELLE—9. Operations for ulcer of the stomach and duodenum.
L. H. FRIEDRICH—2. Management of the complications of gonorrhœa.

Friday

PAUL F. MORF—9. Gall bladder disease and its operative treatment.
ELMER W. MOSLEY—2. Cæsarean section in contracted pelves.

RESEARCH AND EDUCATIONAL HOSPITAL

Monday

H. B. THOMAS—2. Orthopedic surgery.

Tuesday

CARL A. HEDBLOM—10. Thoracic surgery.

Wednesday

JEROME R. HEAD—10. Neurological surgery.
F. H. FALLS—2. Gynecology and obstetrics.

Thursday

J. D. KOUCKY—10. General surgery.

Friday

LINDON SEED—9. Thyroid surgery.
LOUIS SCHULTZ—10. Oral surgery.
F. H. FALLS—2. Gynecology and obstetrics.

POST GRADUATE HOSPITAL

Tuesday

L. GLASSMANN—9. Prolapse of the uterus.
W. SCHAARE—10. Colles fracture.

Wednesday

LEO ZIMMERMAN—10. Vascular diseases of the extremities.
W. A. N. DORLAND—2. Repair of perineum.

Thursday

H. L. MEYERS—9. Hysterectomy.
R. W. HARDON—10. Injection treatment of varicose veins.
EMIL RIES—2. Enterocele vaginalis.

Friday

EMIL RIES—10. Precancerous lesions of cervix uteri.
M. MABEE—2. Treatment of leucorrhea.

ILLINOIS MASONIC HOSPITAL

Tuesday

JOHN R. HARGER—9. Infection of upper abdomen.
ROBERT H. HAYES—10. Infection of the lungs.
B. H. HUGGINS—11. Arthritis.

Wednesday

GILBERT FITZPATRICK—9. Obstetrical surgery.
WILLIAM H. GILMORE—10. Pelvic trauma.
JOHN P. SPRAGUE—11. Orthopedic clinic.

Thursday

HUGH MACKECHNIE—9. Gastro-intestinal surgery.
EDWARD A. WHITE—10. Genito-urinary clinic.
BAYARD HOLMES—11. Myocarditis and surgery.

Friday

MORRIS BLATTS—11. Thymus disease.

GRANT HOSPITAL

Tuesday

A. G. FRYE—9. General surgical clinic.
D. A. ZIMMERMAN—11. General surgical clinic.

Thursday

D. A. ZIMMERMAN—11. General surgical clinic.

Friday

S. COOMBS—9. General surgical clinic.

GARFIELD PARK HOSPITAL

Monday

J. M. BERGER—2. Thyroid clinic, operations and demonstration of cases.
J. R. HARGER—2. Bone transplant; nerve and tendon suture.
CARL BAUER—3. Diagnosis and management of sterility; radium treatment of carcinoma of the cervix.
P. S. SCHMITT—3. Pathological presentations.

Tuesday

FRANK D. MOORE—9. Surgery of the upper abdomen.
THEODORE TEIKEN—9. The medical aspects of the abdominal case.
F. L. BROWN—2. Gall-bladder surgery.

Wednesday

C. C. ROGERS—9. Operative treatment of cranial injuries.
L. F. MACDIARMID—9. Surgery of the abdomen.
VINCENT J. O'CONOR—2. Two-stage suprapubic prostatectomy.
BEVERIDGE MOORE—2. Orthopedic surgery.

Thursday

VICTOR SCHRAGER—2. Surgical treatment of ulcer of the stomach.
C. WELDY—2. Surgery of the gall bladder.
R. H. GOOD—2. Thoracic surgery.

Friday

G. G. FOUSER—9. Surgery of the thyroid.
H. L. BAKER—9. Abdominal surgery.
DR. DAHLE—9. Roentgenology.

SHRINERS' HOSPITAL

Monday

B. H. MOORE—2. Ward visit: demonstration of apparatus in use.

Tuesday

B. H. MOORE—9. Orthopedic operations; use of ethylene anæsthesia for children.
MR. DREHER—2. Demonstration of braces and special apparatus.

Wednesday

B. H. MOORE and associates—2. Demonstration of plaster technique.

Thursday

B. H. MOORE—9. Orthopedic operations.
B. H. MOORE—2. Moving pictures.

Friday

B. H. MOORE—9. X-ray demonstration of unusual conditions.
B. H. MOORE—2. Results in orthopedic cases.

LUTHERAN MEMORIAL HOSPITAL

Tuesday

CHARLES F. STOTZ—9. General surgical clinic.

Wednesday

ARTHUR G. FREY—9. General surgical clinic.

Thursday

CHARLES F. STOTZ—9. General surgical clinic.

Friday

ARTHUR G. FREY—9. General surgical clinic.

SOUTH SHORE HOSPITAL

Monday

FREDERICK RAHE—2. General surgical clinic.
ETHELBERT LUTTON—3. General surgical clinic.

Tuesday

HUGH MACKECHNIE—9. General surgical clinic.
LOUIS D. SMITH—11. Genito-urinary surgery.
MARTIN MERBITZ—2. General surgical clinic.

Wednesday

GUY VAN ALSTYNE—9. General surgical clinic.
GEORGE G. O'BRIEN—11. General surgical clinic.
EDMOND PROBY—2. General surgical clinic.

Thursday

WELLER VAN HOOK—9. General surgical clinic.
AXEL WERELIUS—10:30. General surgical clinic.
EDWARD MASTERTON—2. General surgical clinic.

Friday

FRANK MEAD—9. General surgical clinic.
PAUL ROSBOROUGH—10. General surgical clinic.
FRANK MURPHY—11. Fracture clinic.
LESLIE BLACKWOOD—2. General surgical clinic.

TRAUMATIC SURGERY CLINICS

(In the offices of the Medical Director of the Lumbermen's Mutual Casualty Co., 4750 Sheridan Road)

Monday

FRED J. COTTON, Boston—2. Treatment of ununited fractures.
J. H. SHORTELL, Boston—3. Treatment of fractures of the tibia.
PAUL B. MAGNUSON—3:30. Fractures, extent of permanent disability.

Tuesday

DENNIS R. W. CRILE—2. Ruptured brachial plexis; results of musculo-spiral nerve suture.
WILLIAM M. HARSHA and G. V. PONTIUS—3. Trauma to abdomen; removal of spleen; carcinoma of stomach.
L. P. KUHN—4. Report of 74 cases of trauma to abdomen with immediate operation in 27; extent of permanent disability.

Wednesday

PHILIP H. KREUSCHER—2. Knee joint injuries.
EDWIN W. RYERSON—3. Back injuries, extent of permanent disability.

Thursday

SIDNEY WALKER—9:30. Traumatic eye cases.
LOYAL DAVIS—10:30. Skull fractures.
LEROY THOMPSON—11:30. Traumatic eye cases.

MUNICIPAL TUBERCULOSIS SANITARIUM

Thursday

CARL A. HEDBLOM—9:30. Surgery of the chest in tuberculosis, operative clinic and demonstration of end results.

Friday

CHARLES M. MCKENNA—9:30. Tuberculosis of the kidney, operative clinic and demonstration of pathologic types of renal tuberculosis.
BENJAMIN GOLDBERG and associates—2. Special measures in the general care of surgical tuberculosis.

FRANCES E. WILLARD HOSPITAL

Monday

F. G. DYAS. Surgical treatment of ulcer of the stomach and duodenum.
J. S. NAGEL. Surgery of hydronephrosis.
J. W. CARR. Management of the eclamptic patient.
A. H. C. GOLDFINE. Radium treatment of carcinoma of the cervix.
GEORGE J. RUKSTINAT. Pathological demonstration.

Tuesday

VICTOR L. SCHRAGER. Surgery of the abdomen.
F. A. MACKOWIAK. Treatment of Pott's fracture.
H. CULVER. Urological surgery.

Wednesday

FRANK D. MOORE. Surgery of the gall bladder, operations and demonstration of cases.
JOHN R. HARGER. Tendon grafting and suturing.
M. S. COFFLER. Renal function test in urological surgery.
LUDVIG HEKTOEN. Pathological demonstration.

Thursday

A. E. STEWART and MILTON OCHS. Operative treatment of cranial injuries.
OTIS M. WALTER and S. BIEZES. Thyroid clinic.
E. S. BLAINE. Roentgenology.

Friday

J. P. JAROS. Thyroid clinic.
G. F. THOMPSON. Fracture clinic.
J. A. VALENTINE. Emergency surgery.

MOUNT SINAI HOSPITAL

Tuesday

V. L. SCHRAGER—9. Abdominal surgery with special reference to interpretation and management of surgical risks.

Wednesday

I. E. BISKOW—9. Abdominal surgery.
A. E. KANTER—9. Vaginal plastics; hysterectomies.

Thursday

V. L. SCHRAGER—9. Abdominal surgery with special reference to interpretation and management of surgical risks.
L. HANDELMAN—9. General surgical operations.

Friday

J. MORA and B. A. WILLIS—9. Goiters; fractures.
M. BERNSTEIN—9. Orthopedic surgery: Synovectomies of knee; spinal fusion.

CHILDREN'S MEMORIAL HOSPITAL

Monday

JOHN A. GRAHAM—1. The acute abdomen.

Tuesday

JAY IRELAND—11. The treatment of empyema in children.

Wednesday

FREDERICK B. MOOREHEAD—9. Cleft lip and cleft palate; cartilage transplants for the correction of facial deformities.

Thursday

ALBERT H. MONTGOMERY—9. Pyloric stenosis and intussusception; general surgery of children.

AUGUSTANA HOSPITAL

Tuesday

NELSON M. PERCY—9. Thyroid clinic; general abdominal surgery; spinal anæsthesia.
R. J. ODEN—9. General surgery.

Wednesday

O. E. NADEAU—9. General urological surgery.
J. W. NUZUM—9. General surgery.
E. H. OCHSNER—9. General surgery.
D. W. CRILE—10. Orthopedic surgery.

Thursday

NELSON M. PERCY—9. Thyroid clinic; general abdominal surgery; spinal anæsthesia.
R. J. ODEN—9. General surgery.

Friday

O. E. NADEAU—9. General urological surgery.
J. W. NUZUM—9. General surgery.
E. H. OCHSNER—9. General surgery.
D. W. CRILE—10. Orthopedic surgery.

ILLINOIS CENTRAL HOSPITAL

Tuesday

C. H. PHIFER—9. Dry clinic: Abdominal surgery.
FARIS CHESLEY—10. Medical aspects of acute abdomen.

Wednesday

W. T. HARSHA—9. Thyroid clinic.
L. SLOAN—10. Medical aspects of toxic goiter.
A. H. BAUGHER—11. Pathology of toxic goiter.

Thursday

HUGH MACKECHNIE—9. Dry clinic: general surgery.
J. C. DELPRAT—10. Dry clinic: general surgery.
BEVERIDGE MOORE—11. Orthopedic surgery.
WILLIAM CULPEPPER—11. X-ray demonstration of pathology of Paget's disease.

Friday

W. T. HARSHA and C. C. GUY—9. Dry clinic: General surgery.
WILLIAM HEWITT—10. Dry clinic: Gynecology and obstetrics.

JACKSON PARK HOSPITAL

Tuesday

ARRIE BAMBERGER, A. HENNING, and associates—9. General surgery.
S. B. MACLEOD—2. Traumatic surgery.

Wednesday

ARRIE BAMBERGER, A. HENNING, and associates—9. General surgery.

Thursday

ARRIE BAMBERGER, A. HENNING, and associates—9. General surgery.

Friday

S. B. MACLEOD—2. Traumatic surgery.

ST. BERNARD'S HOSPITAL

Monday

WILLIAM EPSTEIN—2. Goiter clinic.
G. M. CUSHING—2. Gall-bladder clinic.

Tuesday

WILLIAM HECTOR—9. Surgical clinic.
L. B. DONKLE—9. Surgical clinic.
CHESTER GUY—2. Laboratory demonstrations.
J. A. PARKER—2. Surgical clinic.

Wednesday

J. B. HAEBERLIN—9. Surgical clinic.
EMIL RACH—2. Obstetrical clinic.
B. C. CUSHWAY—2. Radium cases.

Thursday

J. T. MEYER—9. Surgical clinic.
W. H. BOHART—9. Industrial surgery.
J. G. FROST—2. Fracture clinic.

HENROTIN MEMORIAL HOSPITAL

Tuesday

CHANNING W. BARRETT—9. Gynecological clinic.

Wednesday

WILLIAM M. THOMPSON—2. Management of abdominal and pelvic adhesions.

LUTHERAN DEACONESS HOSPITAL

Tuesday

JOHN D. KOUCKY—9. General surgical clinic, operations and demonstration of cases.
LINDON SEED—9. Thyroid clinic, operations and demonstration of cases.
GEORGE H. SCHROEDER—9. General surgical clinic, operations and demonstration of cases.

Thursday

JOHN D. KOUCKY—9. General surgical clinic, operations and demonstration of cases.
LINDON SEED—9. Thyroid clinic, operations and demonstration of cases.
GEORGE H. SCHROEDER—9. General surgical clinic, operations and demonstration of cases.

WASHINGTON BOULEVARD HOSPITAL

Tuesday

ARTHUR R. METZ—9. Fracture clinic.

Wednesday

VINCENT J. O'CONOR—9. Urological clinic.

Thursday

PAUL C. FOX—9. Gynecological clinic.

SURGERY OF THE EYE, EAR, NOSE, AND THROAT

COOK COUNTY HOSPITAL

Monday

JAMES P. FITZGERALD—3. Fundus clinic.

Tuesday

WILLIAM F. MONCRIEF—10. Diagnostic and operative eye clinic.
THOMAS J. GALLOWAY—10. Diathermy and malignancies of the mouth and throat.
CHARLES F. YERGER—2. Ophthalmoscopic and surgical clinic.

Wednesday

JAMES P. FITZGERALD—2. Ophthalmoscopic and surgical clinic.
S. SALINGER and S. PEARLMAN—2. Diagnostic clinic; nasal plastic surgery.

Thursday

GEORGE W. BOOT—9. Bronchoscopic clinic.
CHARLES F. YERGER—2. Ophthalmoscopic and surgical clinic.
JAMES P. FITZGERALD—3. Fundus clinic.

Friday

JAMES P. FITZGERALD—2. Ophthalmoscopic and surgical clinic.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

Monday

L. A. SHIPFER and E. E. DILLON. Chronic suppurative otitis media treated with zinc ionization.
JOHN DELPH. Endoscopy.

Tuesday

C. F. BOOKWALTER. Demonstration of intranasal tear sac operation.

Wednesday

OTIS MACLAY. Sinus work.
WILLIAM JOYCE. Demonstration of plastic flap used in radical mastoid operation.

Thursday

CHARLES B. YOUNGER. Atrophic rhinitis.

Friday

R. D. RUSSELL. Demonstration of endolymphatic sac and valve.
ELLISON L. ROSS. Vestibular reaction as affected by drugs.

RUSH MEDICAL COLLEGE

Monday

WILLIAM G. REEDER—3. Ophthalmological clinic.

Tuesday

EARLE B. FOWLER—3. Ophthalmological clinic.

Wednesday

T. D. ALLEN—2. Ophthalmological clinic.

Thursday

WILLIAM G. REEDER—3. Ophthalmological clinic.

Friday

BERTHA KLEIN—3. Ophthalmological clinic.

RESEARCH AND EDUCATIONAL HOSPITAL

Monday

FRANCIS L. LEDERER, JOHN J. THEOBALD, and OSCAR VAN ALYEA—2. Otolaryngological clinic.

Tuesday

HALLARD BEARD—9. Surgery of squint; tucking and tenotomy.
NATHAN SCHNECK—10. Otolaryngological clinic.
SHERMAN SHAPIRO and ARTHUR J. COOMBS—2. Otolaryngological clinic.
FRANCIS L. LEDERER—2. Otolaryngological operations.

Wednesday

I. G. SPIESMAN—10. Otolaryngological clinic.
FRANCIS L. LEDERER, WALTER H. THEOBALD, and JOHN J. THEOBALD—2. Otolaryngological clinic.

Thursday

GEORGE S. LIVINGSTON—10. Otolaryngological clinic.
SHERMAN SHAPIRO and ARTHUR J. COOMBS—2. Otolaryngological clinic.
JOHN J. THEOBALD—2. Otolaryngological operations.

Friday

MAX L. FOLK and SAUL C. GREENWALD—9. Plastic operations on the eyelids.
J. HARNED—10. Otolaryngological clinic.
FRANCIS L. LEDERER—2. Otolaryngological clinic.

MICHAEL REESE HOSPITAL

Monday

M. L. FOLK—2. Diagnosis and treatment of iritis.

Tuesday

SAMUEL J. MEYER—2. Operations for glaucoma.

Wednesday

ROBERT VON DER HEYDT—2. Slit-lamp microscopy of the living eye.

Thursday

S. C. GREENWALD—2. Operations for strabismus.

Friday

ROBERT VON DER HEYDT—2. Photography of the anterior segment of the eye.

ILLINOIS CENTRAL HOSPITAL

Tuesday

J. H. MCLAUGHLIN—9. Ear, nose and throat clinic.
H. J. SMITH—9. Emergency surgery of the eye, industrial injuries.

Wednesday

J. H. MCLAUGHLIN—9. Ear, nose and throat operative clinic.
H. J. SMITH—9. Emergency surgery of the eye, industrial injuries.

Thursday

J. H. MCLAUGHLIN—9. Ear, nose and throat clinic.
H. J. SMITH—9. Emergency surgery of the eye, industrial injuries.

Friday

J. H. MCLAUGHLIN—9. Ear, nose and throat operative clinic.
H. J. SMITH—9. Emergency surgery of the eye, industrial injuries.

EYE, EAR, NOSE, AND THROAT HOSPITAL

Monday

A. R. Hollender—2. Physical therapy clinic; practical demonstration of the application of electrotherapy to the eye, ear, nose and throat.
T. S. Kammerling—2. Eye clinic.
H. B. Fuller—2. Ear, nose and throat clinic.
Ignaz Sommer—4:30. Intracranial relation to ear, nose and throat.

Tuesday

H. B. Fuller and D. C. Brown—9. Ear, nose and throat surgical clinic.
O. B. Nugent—11. Surgical treatment of chronic dacrocystitis.
W. A. Fisher—2. Simplified Barraquer operation for cataract extraction.
R. Castroviejo—4. Demonstration of various methods of ophthalmoscopy (simplified Gullistrand, giant Gullistrand, red free light, direct and indirect).

Wednesday

T. S. Kammerling and L. Savitt—9. Ear, nose and throat surgical clinic.
Joseph Beck—9. Surgical treatment of carcinoma of the larynx.
O. B. Nugent—11. Photography as applied to the practice of ophthalmology. Demonstration of making of photographic records in ocular diseases; in plastic surgery. Anterior stereopticon camera; fundus photography; making of lantern slides; photomicroscopy. Motion pictures.
T. S. Kammerling—2. Eye clinic.
H. B. Fuller—2. Ear, nose and throat clinic.
Ignaz Sommer—4:30. Tuning forks.

Thursday

O. B. Nugent—9. Cataract clinic: Cataract extraction by simplified Barraquer method; teaching of cataract extraction by motion pictures.
R. Castroviejo—11. Practical demonstration of slit-lamp microscopy.
H. B. Fuller—2. Eye clinic.
T. S. Kammerling—2. Ear, nose and throat clinic.
Ignaz Sommer, R. Castroviejo, and E. Gallardo—2. Demonstration of various laboratory methods and the practical application of clinical findings.
R. Castroviejo—4:30. Histopathology.

Friday

H. B. Fuller, T. S. Kammerling and O. M. Steffenson—9. Ear, nose and throat surgical clinic.
Joseph Beck—9. Pathology of the ear, nose and throat.
H. W. Woodruff—11. Deep iridectomy for glaucoma; tucking operation for strabismus.
T. S. Kammerling—2. Eye clinic.
H. B. Fuller—2. Ear, nose and throat clinic.
Ignaz Sommer—4:30. The rôle of the nasal accessory sinuses in nasal diseases.

JOHN B. MURPHY HOSPITAL

Monday

G. W. Mahoney. Emergency surgery of the eye; industrial injuries.

Tuesday

Edward Garraghan. Operations for acute glaucoma.

Wednesday

S. Sciarretta. Indications for operative treatment in acute mastoiditis.

ILLINOIS EYE AND EAR INFIRMARY

Monday

Mayer H. Lebensohn and Edward H. Garraghan—2. Plastic surgery of eyelids.
U. J. Grim—2. Mastoid.

Tuesday

Herbert S. Walker—2. Ocular muscles.
Michael Goldenburg—2. Some late phases of glaucoma.
Oscar Cleff—2. Mastoid.
Charles F. Yerger—2. Radical nasal sinus operations.

Wednesday

Dwight C. Orcutt and Robert H. Buck—2. Ocular muscles and operative trachoma.
Henry Boettcher—2. Tonsils and mastoid.

Thursday

Ephraim K. Findley—2. Cataract operations.
Edward N. Schoolman—2. Bronchoscopy and plastic surgery.

Friday

E. R. Crossley—2. Cataract operations.
Alfred Lewy—2. Nasal sinuses and mastoid.

POST GRADUATE HOSPITAL

Monday

J. Hayden—2. Accessory sinuses.

Tuesday

S. Sher—11. Benign growth of vocal cord.
B. Cushman—2. Trephine for glaucoma.
W. M. Wolin—3. Septum and tonsils.

Wednesday

E. Stewart—9. Glaucoma.

Friday

S. Wiener—9. Nasal polyps and accessory sinuses.

MOUNT SINAI HOSPITAL

Wednesday

Noah Schoolman, Jacob Lifschutz, and associates—3. Bronchoscopy and lipiodol injections in pulmonary conditions; œsophagoscopy.
Noah Schoolman, Jacob Lifschutz, and associates—2. Lipiodol studies and operations on accessory sinuses; X-ray studies and operations for ear conditions.

LAKE VIEW HOSPITAL

Monday

Frank J. Novak, Jr.—2. Suspension laryngoscopy.

Wednesday

Robert H. Buck—9. Demonstration of various eye operations.

ILLINOIS MASONIC HOSPITAL

Friday

T. J. Williams—9. Otolaryngological clinic.
W. S. Boynton—10. Scientific exactness in the differential diagnosis and operative treatment of strabismus.

MUNICIPAL TUBERCULOSIS SANITARIUM

Thursday

Francis Lederer—2. Tuberculosis of the larynx and bronchoscopy demonstrations.

ST. JOSEPH'S HOSPITAL

J. HOLINGER, AUSTIN A. HAYDEN, E. W. GARDNER, T. E. BLOMBERG, R. H. HENDERSON, and H. A. RAMSER—9, daily, Tuesday to Friday inclusive. Operative clinics and demonstrations in the departments of otolaryngology and ophthalmology, in collaboration with WILLIAM H. BURMEISTER, F. O. FREDRICKSON, and LELAND SHAFER of the department of internal medicine; CHARLES SCHOTT, GUSTAVE KAMPMEIER, MAURICE BLATT, and T. P. SALTIEL of the department of pediatrics; L. A. HINES of the department of pathology; and E. W. JENKINSON of the department of radiology.

Pharynx and larynx—Senile tonsillectomy, case histories with results; sutures in the tonsil fossa for control of hæmorrhage; wax molds for graphically illustrating and recording conformation of nasopharynx and posterior nasal choanae; direct laryngoscopy.

Accessory nasal sinus disease—Incidence in adults, children and infants; presentation of case histories and results; lipiodol and percussion and auscultation as a diagnostic aid.

Tear sac disease—External and internal nasal operations.

Nasal fractures—Diagnosis and treatment, photographs and casts for graphic records.

Ear—Demonstration of audiometers (by courtesy of Graybar Electric Co.) for group and individual hearing tests; indications for operation in acute mastoiditis, case histories; Pohlmann's stapedius muscle exercise and results.

J. HOLINGER—12, daily. Demonstration of microscopic and macroscopic temporal bone specimens.

Moving pictures, lantern slides, and chalk talks will be used to illustrate certain features of the above program.

WESLEY MEMORIAL HOSPITAL

Monday

T. P. O'CONNOR—2. Ear, nose and throat clinic, operations.

Tuesday

GORDON WILSON—9. Otological surgery.

WASHINGTON BOULEVARD HOSPITAL

Tuesday

LINN F. MCBRIDE—2. Nose and throat clinic.

Wednesday

CASSIUS and VIRGIL WESCOTT—2. Eye clinic.

Thursday

LINN F. MCBRIDE—2. Nose and throat clinic.

CHICAGO MEMORIAL HOSPITAL

Monday

RICHARD H. STREET—4. Tonsillectomies under local and general anæsthesia.

Tuesday

ALFRED E. LEWY and RICHARD W. WATKINS—3. Mastoids.
IRVING I. MUSKAT—4. Plastic surgery.

ALBERT MERRITT BILLINGS HOSPITAL

Monday

D. KATZ—2. Eye clinic.

Thursday

LOUIS BOTHMAN—9. Eye clinic.

PRESBYTERIAN HOSPITAL

Monday

DANIEL HAYDEN—2. Ear, nose and throat clinic.

Tuesday

GEORGE E. SHAMBAUGH and associates—2. Otolaryngological clinic.
WILLIAM H. WILDER and associates—2. Ophthalmological clinic.
EDWIN MCGINNIS—2. Ear, nose and throat clinic.

Wednesday

GEORGE E. SHAMBAUGH and associates—2. Otolaryngological clinic.
WILLIAM H. WILDER and associates—2. Ophthalmological clinic.

Thursday

GEORGE E. SHAMBAUGH and associates—2. Otolaryngological clinic.
WILLIAM H. WILDER and associates—2. Ophthalmological clinic.
EDWIN MCGINNIS—2. Ear, nose and throat clinic.

WOMEN AND CHILDREN'S HOSPITAL

Tuesday

GERTRUDE THOMPSON—9. Tonsillectomies, Beck method.

Wednesday

LILLIAN TAYLOR—9. Tonsillectomies, Sluder method.
GEORGIANA D. THEOBALD—9. Cataract operation.
BEULAH CUSHMANN—9. Operation on eye.

Thursday

ALICE K. HALL—9. Tonsillectomies under local anæsthesia, dissection method.

NORTH CHICAGO HOSPITAL
(At Grant Hospital)

Tuesday

HARRY L. POLLOCK—9. Surgical treatment of acute mastoiditis.

Thursday

HARRY L. POLLOCK—9. Intranasal surgery.

WEST SIDE HOSPITAL

Wednesday

W. L. NOBLE—9. Surgery of the eye.

Thursday

J. A. CLARK and A. E. LUND—9. Tonsillectomies.

ST. LUKE'S HOSPITAL

Tuesday

JOHN A. CAVANAUGH and EDWARD P. NORCROSS. Nose and throat clinics.

Friday

JOHN A. CAVANAUGH and EDWARD P. NORCROSS. Nose and throat clinics.

GRANT HOSPITAL

Tuesday

O. KRAFT—9. Eye clinic.

EVANGELICAL DEACONESS HOSPITAL

Monday

ARTHUR GEIGER—2. Deflections of the nasal septum.

Tuesday

G. THOMPSEN VON COLDITZ—2. Types of tonsil operations.

COLUMBUS HOSPITAL

Tuesday

C. O. LINDSTROM—9. Mastoiditis and various types of tonsillectomies.

Wednesday

L. R. MELLEN—9. Plastics on nose.

RAVENSWOOD HOSPITAL

Friday

A. N. MURRAY and W. J. NOONAN—2. Otolaryngological clinic.

FRANCES E. WILLARD HOSPITAL

Monday

W. D. BRODE and C. T. CARR. Nose and throat clinic.

Tuesday

FRANK J. NOVAK. Acute mastoiditis.

GARFIELD PARK HOSPITAL

Tuesday

L. B. PHELPS—9. Indications for operative treatment in acute mastoiditis.

CHILDREN'S MEMORIAL HOSPITAL

Tuesday

MORRIS COTTLE—9. Surgical and non-surgical ear diseases in infancy.